NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

BALLISTIC MISSILE SUBMARINES OF THE UNITED STATES AND THE SOVIET UNION: A COMPARISON OF SYSTEMS AND DOCTRINE

by

Thom W. Ford

December 1982

Thesis Advisor: D. C. Daniel

Approved for public release; distribution unlimited

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER	2. GOVT ACCESSION NO. / 3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle): Ballistic Missile Submarines of the United States and the Soviet Union: A Comparison of Systems and Doctrine	5. TYPE OF REPORT & PERIOD COVERED: Master's Thesis, December 1982 / 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s): Thom W. Ford	8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Naval Postgraduate School, Monterey, California 93940	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS: Naval Postgraduate School, Monterey, California 93940	12. REPORT DATE: December 1982 / 13. NUMBER OF PAGES: 126
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)	15. SECURITY CLASS. (of this report): UNCLASSIFIED / 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

United States and Soviet Strategic Doctrine, SSBN, SLBM, Ballistic Missile Submarine, Fleet Ballistic Missile Systems, Submarine Launched Ballistic Missiles, Nuclear Doctrine

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This thesis compares the development of fleet ballistic missile systems in the United States and Soviet Union and their contribution to the achievement of national security objectives of each nation. To this end, submarine and missile technologies, elements of operational practices and support, and general strategic doctrine, are traced. A comparative assessment of weapon system effectiveness and potential in achieving stated objectives

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE
S/N 0102-014-6601

is derived from capabilities, peacetime employment, and wartime plans as stated in open doctrinal documents.

Approved for public release; distribution unlimited

Ballistic Missile Submarines of the United States and the Soviet Union: A Comparison of Systems and Doctrine

by

Thom W. Ford
Lieutenant Commander, United States Navy
B.A. Wake Forest University, 1972

Submitted in partial fulfillment of the requirements for the degree of

MASTER OF ARTS IN NATIONAL SECURITY AFFAIRS

from the

NAVAL POSTGRADUATE SCHOOL

December 1982

ABSTRACT

This thesis compares the development of fleet ballistic missile systems in the United States and Soviet Union and their contribution to the achievement of national security objectives of each nation. To this end, submarine and missile technologies, elements of operational practices and support, and general strategic doctrine, are traced. A comparative assessment of weapon system effectiveness and potential in achieving stated objectives is derived from capabilities, peacetime employment, and wartime plans as stated in open doctrinal documents.

TABLE OF CONTENTS

I. INTRODUCTION

For more than two decades the United States and the Soviet Union have been constructing and improving ballistic missile submarines and their weapons systems in support of evolving military and political nuclear strategies. There are advantages in basing strategic missiles in submarines which are enabled by the platforms' mobility and stealth. Improvement in technology have afforded more flexibility in operations and war and peace-time assignments.

The doctrine which governs the employment of strategic systems should reflect national security priorities, external military threats and the capabilities of one's own forces. In the case of ballistic missile submarines, both the United States and the Soviet Union have developed and altered strategic plans to incorporate the advantages afforded by undersea destructive potential. Those plans include statements of peace-time employment for deterrence of the enemy and targeting assignments for fighting a war.

A comparison of U.S. and Soviet submarine ballistic missile systems development, and accompanying public doctrine of purpose and planned utilization in peace and war-time, provide the basis for an assessment of the effectiveness of current and proposed weapons systems in their contribution to national security.

Sections II and III outline the development of the submarines and submarine ballistic missiles of the United States and Soviet Union respectively. Section IV presents operational considerations which affect weapons system employment such as personnel basing and support, patrols and communications. Sections V and VI trace the history of U.S. and Soviet strategic doctrine, particularly those elements which govern employment of ballistic missile submarines. Section VII looks at the future of SSBNs as determined by technology and international politics and VIII summarizes the research on a comparative United States vs. Soviet Union basis.

Delineation of the meaning of the following abbreviations facilitates the presentation of the material:

SSBN: Nuclear-powered ballistic missile submarine

SSB: Conventionally-powered (diesel) ballistic missile submarine

SLBM: Submarine-launched ballistic missile

FBM: "Fleet ballistic missile," often used to refer collectively to the submarine and missile systems.

II. SSBN AND SLBM DEVELOPMENT OF THE UNITED STATES

A. INITIAL PROGRAM

The United States commissioned the world's first nuclear powered submarine, U.S.S. Nautilus, in September 1954. In November of the following year the Secretary of Defense launched the Navy on a joint program with the Army of ballistic missile development. Designated IRBM #2 (IRBM: intermediate range ballistic missile), the project's dual objectives were to achieve an initial sea-based ballistic missile capability with the Jupiter missile and to provide a competitive alternative to the Air Force program, IRBM #1. [Ref. 1: pp. 22-23]

Considerable opposition to the project arose within the Navy for two reasons. Previous interservice rivalry with the Air Force over mission responsibilities had led to the politically motivated scrapping of a new 'super' aircraft carrier in 1949. Second, the opportunity costs in terms of more conventional weapons systems raised doubts about the value of the new concept. [Ref. 2: p. 42] However, Admiral Arleigh Burke, then Chief of Naval Operations, disagreed with the program's detractors and heartily supported continuance of research.

The combined Army-Navy venture was tasked with exploring the land and sea potentials of the Jupiter IRBM. To manage his service's portion of the project, the Secretary of the

Navy created a new agency, the Special Projects Office, and named Vice Admiral William F. Raborn as its first director. [Ref. 1: p. 23] From the outset, Raborn's work was pressed by a sense of urgency because of Soviet advances in hydrogen bomb and ICBM technology. [Ref. 2: p. 41]

Jupiter was a cumbersome and heavy 60 foot missile. Its engine was inherently troublesome because of volatility of the liquid fuel, complexity of preparation for launch and maintenance problems. Considering these characteristics unsuitable for sea-basing, the Navy began alternate development of "Jupiter S," a pared down 44 foot hybrid of the original with solid fuel engines. However, size remained a problem. The "S" weighed 80 tons and was estimated to require an 8,500 ton submarine to carry a payload of four missiles. [Ref. 1: pp. 26-27] After two years of unsatisfactory work, the joint project with the Army was scrapped.

By the summer of 1956, Admirals Burke and Raborn supported development of an entirely new solid fuel ballistic missile. Planned specifications for the weapon included a weight of eight to fifteen tons, a low yield nuclear warhead and a range of 1,000 to 1,500 miles. New concepts in submarine design and technology were concurrently explored to launch the missile. Both aspects of the system, missile and submarine, came under the aegis of the Special Projects Office and were collectively named the Fleet Ballistic Missile (FBM) Program. [Ref. 1: pp. 1,2,30-31]

The development of the first operational ballistic missile submarine was a huge venture, employing 30,000 contractors and government agency personnel. Among the participants were Lockheed Aircraft, the missile system manager; Aerojet-General Corporation, which produced the solid propellant; Dr. C. I. Draper of M.I.T., who developed the inertial guidance system for the missile; the Atomic Energy Commission, which built the warhead; and Vice Admiral Hyman G. Rickover of the Nuclear Power Directorate, who was responsible for the submarine power plant. [Ref. 1: pp. 11, 80-81, 91] To coordinate their efforts, the Special Projects Office utilized P.E.R.T. (Program Evaluation and Review Technique), a revolutionary computerized management program which analyzed problems and identified potential trouble areas. [Ref. 3: p. 174]

The FBM Program was and is considered a great success attributable to American science and industry. The missile systems, called Polaris, deployed several years ahead of the original schedule and with no cost overruns. [Ref. 1: p. 11] Fulfillment of the single mission requirement, sea-based deterrent missile forces, tied numerous technologies together and at the peak of production in 1964, twelve submarines were commissioned in one year.

B. POLARIS MISSILE: THE FIRST U.S. SLBM

Polaris is designated an IRBM with a range of less than 3,000 miles. Missiles with greater ranges warrant designation

as ICBM's or intercontinental ballistic missiles. The missile expends essentially all of its energy in the early boost phase, has an inertial guidance system and reaches speeds in excess of 15,000 miles per hour. The original concept of submerged launch called for compressed gas to push the missile to the surface where its rocket motors would ignite. The method was later modified to a steam ejector system in which a small rocket motor burns, pouring extremely hot gases into a water-filled chamber. Instantaneously produced steam then ejects the missile from the launcher. [Ref. 4, 1966-67: p. 338]

Three versions of the Polaris missile were built by Lockheed's Aerospace Division, designated A-1, A-2 and A-3. A-1 was an interim weapon, rapidly designed and tested to keep pace with accelerated weapon system deployment schedules. An A-1 was first test fired from a submerged submarine in July 1960.[1]

Two years later, production of the A-2 achieved originally planned specifications, particularly in required range. (See Table I)

A-3 incorporated advances in technology learned from its predecessors. [Ref. 1, pp. 10, 11] Project Antelope, completed in 1966, improved the latest Polaris version's capabilities in defense penetration and engine performance.

---

[1]In 1978, the Department of Energy disclosed that mechanical defects had rendered three-fourths of the A-1's warheads inoperative. [Ref. 5]

Increased penetration was achieved through the MRV (multiple re-entry vehicles) concept. Three separate warheads could be launched from a single A-3's final 'bus' stage. The warheads would re-enter the earth's atmosphere in a shotgun pattern with the intended target at the center. Although not independently targeted, as in MIRVed missiles, the multiplication of warheads served to complicate the problem posed by the Polaris for anti-ballistic missile defenses. [Ref. 6: p. 17]

C. THE FIRST SSBN's: GEORGE WASHINGTON AND ETHAN ALLEN CLASSES

Naval construction programs of Fiscal Year 1958 authorized the start of new submarines to launch the Polaris missile. The first boats, the George Washington class SSBN, evolved from a modified Skipjack SSN design. To provide for sixteen launch tubes in two rows of eight, 130 feet were added to the hull of the original 251 foot submarine. New fire control and missile support systems completed the modifications. In all, five submarines of this class were built between 1959 and 1961. The George Washington class SSBNs first put to sea armed with A-1 or A-2 missiles, but subsequently converted to the A-3 during refit periods. [Ref. 4, 1964-65: p. 370]

The Ethan Allen class SSBNs were the first to be specifically and originally designed to carry ballistic missiles. Five Allen class boats were built between 1961 and 1963 and were equipped with the A-2 and later, the A-3

Polaris missile. Although deeper diving than her predecessors, the Ethan Allen brought no breakthroughs in new naval strategic capabilities.

D. LAFAYETTE/FRANKLIN CLASS SSBN

While construction of the Allen class submarines was ongoing, new designs and funds authorized a third and fourth class of U.S. SSBNs. Between 1963 and 1967 the Navy launched nineteen Lafayette and twelve Benjamin Franklin class submarines. The two classes are very similar in appearance, equipment and capabilities. The Franklin boats incorporate minor modifications such as quieter machinery.

The first eight submarines of the Lafayette/Franklin class were fitted with the A-2 missile and the rest with the MRV A-3. By 1966, with the completion of the last of this class, the U.S. Navy manned forty-one deterrent submarines with 656 missiles. [Ref. 7: pp. 20-21]

E. POSEIDON

New concepts in ballistic missile technology were introduced in the mid-1960s. Multiple Independently Targeted Re-entry Vehicles, or MIRV's, when launched from a single missile's bus stage, could saturate any planned Soviet anti-ballistic missile systems. Shortly after burn-out of the propulsion stages, the bus would be pointed at a target, release a warhead, and then redirect to another target and fire until all warheads were expended. If a single target

were the objective, warheads could approach at widely spaced intervals and on different trajectories. [Ref. 6: p. 22] MIRV technology, coupled with other advances in guidance, made possible the potential to destroy hard targets such as bunkers and missile silos as well as soft targets such as cities and airfields.

The SLBM which incorporated these advances was built by Lockheed and designated Poseidon C-3 in January, 1965. [Ref. 1: p. 220] Poseidon is about twice as heavy as the Polaris A-3 but can carry four times the payload. Some of the ten to fourteen warheads carried on a single bus stage can be traded off for increased range or anti-ballistic missile penetration aids. The currently reported C.E.P. (circular error probability) of the warhead is about 1,500 feet, not accurate enough for hardened targets according to the Department of Defense. [Ref. 6: p. 22] The Improved Accuracy Program was initiated to decrease the C.E.P. to 1,000 feet by the early 1980's. [Ref. 8: p. 114]

Between 1970 and 1974 the thirty-one Lafayette and Franklin class SSBNs were converted to fire Poseidon. The George Washington and Ethan Allen were not modified because of their age and prohibitive cost of modification. Navy yards fitted the boats with the Poseidon during normal overhaul along with replacement of nuclear cores. The missile tubes were enlarged, the fire control system replaced, and a new satellite communications tranceiver was installed.

[Ref. 6: p. 22] In 1975, Secretary of Defense, James R. Schlesinger noted that with the completion of the Poseidon program, the FBM arm of the nuclear triad, the least vulnerable of American strategic forces, accounted for 30% of the total 2,150 launch vehicles and 55% of the 9,000 separate warheads or re-entry vehicles. [Ref. 9, 1975-76: p. 404]

F. TRIDENT SYSTEMS

As early as 1967, new concepts and technologies were developing for the sea-based deterrence force of the 1980's. Collectively called ULMS (Underwater Launched Missile System), the research projects included an 8,000 ton, 450 foot SSBN designed by Electric Boat Division of General Dynamics to take advantage of advances in noise reduction, crew habitability, communications, modular construction and maintenance techniques. The new submarine was designed to carry a longer range and more accurate missile than Poseidon.

ULMS was initiated to confront projected Soviet advances in anti-submarine warfare. In 1969, Secretary of Defense Melvin Laird felt that a determined effort by Moscow in ASW would render current SSBN's too vulnerable. [Ref. 4, 1969-70: p. 26] However, detractors noted that the Soviets were not, in fact, making much progress in anti-submarine warfare and, therefore, there was no need for improved sea-based deterrence. [Ref. 6: p. 26] Low budgeting in fiscal years 1969 through 1971 reflected lingering doubts about the viability of ULMS.

By 1972, a continuing Soviet build-up in strategic offensive forces caused new interest in the program, now named "Trident." To accelerate progress, the project managers divided their efforts into two phases. Initially, a new long range improved missile was to be developed for deployment with Lafayette/Franklin class submarines in the late 1970's. A new submarine, to fire an even more capable missile was planned for deployment in the 1980's. [Ref. 4, 1972-73: p. 409]

The first Trident missile, designated C-4, has a C.E.P. similar to Poseidon at a greater range. (See Table I) However, a flight path equal to Poseidon's maximum range yields greater accuracy, less than 1,000 feet C.E.P. In flight, the missile uses a stellar sensor, taking star sights immediately after launch and during the post boost phase to correct its course. [Ref. 8: p. 114; Ref. 10]

Conversions of Poseidon boats to Trident C-4 began in 1979 and will be completed on the twelve newest Lafayette/Franklin SSBN's by about 1983. Required modifications include minor alterations of the launchers and ballasting because of increased missile weight, and extensive changes in the fire control and missile support systems. The first operational Trident patrol was in December, 1979. [Ref. 11, 1979-80: p. 655, 1981-82: p. 618]

G. OHIO CLASS SSBN

U.S.S. Ohio (SSBN 726), the lead submarine of the new Trident weapon system, was laid down in April, 1976 by Electric Boat Division. Design and construction problems delayed expected launch and commissioning dates several times. [Ref. 11, 1981-82: p. 617] Support of the program has waxed and waned frequently because of its great monetary and opportunity costs. Ongoing strategic arms limitation or reduction talks may impact on eventual force levels. President Reagan has announced a planned procurement rate of one submarine per year for a current total funding request of twelve boats. [Ref. 12: p. 5] U.S.S. Ohio was commissioned November 11, 1981, and arrived at Bremerton, Washington in August 1982 to prepare for its first operational patrol.

H. COMPARISONS AND ADDITIONAL DEVELOPMENTS

Table I depicts the development of United States SLBM's. Each successive missile that has become operational has increased in size and capabilities. The A-1 which served as an interim weapon retired from service in October 1965. The A-2 and A-3 versions of Polaris brought improved range, accuracy and MRV technology to the fleet and were in the active fleet until 1981.

The Poseidon C-3 halved previous SLBM accuracy as measured by C.E.P. and introduced MIRV capability to the FBM force. The missile will continue to deploy aboard Lafayette/Franklin class SSBN's into the 1990's.

The Trident I C-4 achieves the greatest accuracy of any operational SLBM through incorporation of stellar guidance corrections to the inertial system. Increased range is attributed partially to an 'aerospike' which deploys from the missile's nose on launch to reduce aerodynamic drag. [Ref. 13: p. 17] First deployed in 1979, the C-4 will eventually be fitted out in twelve Lafayette/Franklin class SSBN's. It will also deploy with the Ohio class boats until the follow-on D-5 missile is completed in the late 1980's.

Table II traces U.S. SSBN development over the past twenty-five years. Until the commissioning of U.S.S. Ohio, all of the submarines were similar in size and capabilities. Jane's Fighting Ships has noted the homogeneity of the American SSBN force with thirty-one of the forty-one total SSBN's of the closely related Lafayette and Franklin classes. [Ref. 4, 1964-65: p. vi] The Ohio, however, represents a significant increase in size and capability, equipped with twenty-four vice sixteen missile launchers as well as advanced electronic and computer support systems.

All U.S. SSBN's are nuclear powered with a geared reduction system driving a single shaft. Additionally, they are equipped with passive sonars including towed arrays and either two or three Ship's Inertial Navigation Systems (SINS), which allow accurate internal submarine navigation. With SINS, position information can be crossed-checked by optical-stellar, electronic and satellite means. In addition to

providing submarine navigation information, the equipment's data is fed to the missiles' guidance systems for position update until the instant of firing. [Ref. 4, 1971-72: p. 408]

Table III summarizes the total deterrent submarine assets available to United States leaders over the years. The 1960's experienced a rapid build-up of the Polaris force which resulted in block obsolescence of ten boats between 1979 and 1981. The Washington and Allen class submarines have been removed from the deterrence force, scheduled for conversion to SSNs and eventual dismantling when their nuclear cores are spent. [Ref. 11, 1981-82: p. 264]

As each Ohio class boat enters the fleet, it brings twenty-four Trident I missiles to the fleet. Eventual force levels will offset retirement of Lafayette and Franklin class submarines in the 1990s. Those boats, however, will continue to deploy with Poseidon and Trident I missiles for the next decade.

Although total submarines remained constant at 41 from 1967 until 1981, capabilities increased geometrically with the introduction of the MIRVed Poseidon missile. Concurrently, missile ranges constantly improved, expanding the operating area and the reach into Soviet territory of the SSBN force.

The continuities of the U.S. FBM program have strengthened its effectiveness in the nuclear triad. Consistently nuclear powered, the submarines have remained the state of the art

in stealth and on-station sustainability. The ability to construct and convert compatible submarines and missiles over the years have allowed gradual but steady and less costly improvements in weapon system capabilities and their rapid introduction into the fleet. Consequently, over the past twenty-two years, U.S. presidents have consistently relied upon a submarine deterrent force of substantial capability and destructive potential.

TABLE I

UNITED STATES SUBMARINE LAUNCHED BALLISTIC MISSILES

MISSILE	DESCRIPTION	DATE FIRST DEPLOYED	LENGTH (FEET)	WEIGHT (POUNDS)	RANGE (NAUTICAL MILES)	WARHEAD DESCRIPTION	ACCURACY[1] (C.E.P.)
Polaris A-1	Two Stage, Solid Fuel	1960	28.5	28,800	1200	Single, One Megaton	1 to 2 miles
Polaris A-2	Two Stage, Solid Fuel	1962	31	32,500	1500	Single, One Megaton	1 to 2 miles
Polaris A-3	Two Stage, Solid Fuel	1964	32	35,700	2500	Single until 1966, then MRV, 3 warheads	3000 feet
Poseidon C-3	Two Stage, Solid Fuel	1970	34	64,000	3000	10 to 14 50 kiloton warheads per missile, MIRV	1500-1800 feet
Trident I C-4	Three Stage, Solid Fuel	1979	34	70,000	4000	10 to 14 50 kiloton warheads; MIRV; Stellar Post-Boost Guidance	Less than 1000-1500 feet

[1] C.E.P. = Circular error probability or 50% of missiles fall within radius of indicated distance.

[Refs. 4, 9, 11]

TABLE II

UNITED STATES BALLISTIC MISSILE SUBMARINES

CLASS	MAIN MACHINERY	NUMBER BUILT	DIMENSIONS (FT) LENGTH/BEAM/DRAFT	DISPLACEMENT (TONS) SURF/DIVED	SPEED (KTS) SURF/DIVED	MISSILE SYSTEMS	TORPEDO SYSTEMS
George Washington	S5W NUC Reactor 15000 SHP	5	382/33/29	5900/6700	20/30	16 x A-1, A-2 or A-3	4 x 21"
Ethan Allen	S5W NUC Reactor 15000 SHP	5	411/33/30	6900/7900	20/30	16 x A-2, or A-3	4 x 21"
Lafayette/ Benjamin Franklin	S5W NUC Reactor 15000 SHP	31 (19/12)	425/33/32	7320/8250	20/30	16 x A-2 (8 boats), A-3 (23 boats), C-4 (12 boats after 1979)	4 x 21"
Ohio	S8G NUC Reactor 60000 SHP	2+	560/42/37	16600/18700	?/20+	24 x C-3	4 x 21"

[Refs. 4, 9, 11]

TABLE III

UNITED STATES UNDERSEA STRATEGIC CAPABILITIES BY YEAR

YEAR	TOTAL SSBNS	TOTAL LAUNCHERS	TOTAL WARHEADS OR INDEPENDENTLY TARGETED VEHICLES	OPERATIONAL RANGE (NAUTICAL MILES)	CAPABILITIES
1960	2	32	32	1200	A-1 Missile
1	5	80	80		
2	9	144	144	1200-1500	A-2 Missile
3	16	256	256		
4	29	464	464	1200-2500	A-3 Missile MRV
5	33	528	528	1500-2500	
6	40	640	640		
7	41	656	656		
8					
9					
1970					
1			>1500	1500-3000	Poseidon C-3 conversion on 31 SSBNs, MIRV
2			>2300		
3			>3200		
4			>4000		
5					
6					
7					
8					
9				1500-4000	Trident I C-4 conversions on 12 SSBNs, MIRV
1980					
1	35	560			
2	31	496		3000-4000	

[Refs. 4, 9, 11)

III. SSB, SSBN AND SLBM DEVELOPMENT OF THE SOVIET UNION

A. EARLY CONCEPTS

A lack of Soviet interest in nuclear powered submarines in the immediate post-World War II period is attributed by Norman Polmar to Joseph Stalin's personal disinterest in the concept. [Ref. 14: p. 31] Although research was underway on naval nuclear power plants in the late 1940s, Stalin felt that traditional elements of military mass and battlefield determination rather than new technology would triumph over the West. His defense programs are a reflection of this conservative view. In the years before Stalin died in March 1953, a huge fleet was planned, including the construction of 1,200 diesel submarines.

Following a brief period during which he consolidated power, Nikita Khrushchev reversed many of Stalin's policies, including those governing the military and national defense. Emphasis for the navy, or VOENNO-MORSKOI FLOT (VMF), shifted from large costly traditional ships to destroyer-size units, naval aircraft and submarines, all to be equipped with the new missile technologies. In 1955, Khrushchev fired Admiral N. G. Kuznetsov, the conservative chief of the VMF, replacing him with 45-year-old S. G. Gorshkov, a naval officer with a reputation for innovation and imagination. Both Khruschev and Gorshkov envisioned a 'revolution' in military affairs

through the advent of nuclear technology and missile weapon systems. [Ref. 14: pp. 32-34]

In the 1950's, the mission of strategic strike fell upon the Navy at a time when a submarine torpedo was the only means available to bring atomic weapons to bear on the continental United States. By 1955, to replace this meager offensive capability, top priority was assigned to the development of submarine launched ballistic missiles. [Ref. 15: p. 148] Admiral Gorshkov would later reflect on early Soviet experiments in the new concept, and the parallel lack of success that the United States Navy encountered with the Jupiter IRBM. He understood the requirement for 'revolutionary' systems:

> The need for the rigid limitation of the mass-dimensional characteristics of missiles for submarines demanded the creation of special sea ballistic missiles. [Ref. 16: p. 193]

To conduct tests and sea trials for experimentation in SLBMs, the VMF lengthened and heightened the sail of a "Zulu" class diesel-powered attack submarine (SS) and added two vertical launch tubes. In September 1955, the boat first launched a Soviet ballistic missile while surfaced, and by 1961, six of the Zulus, now designated Zulu-V, had been converted to SSBs at the Zhdanov Shipyard in Leningrad. [Ref. 17: p. 150]

B. DUAL CONVENTIONAL/NUCLEAR DEVELOPMENT

The Severodvinsk Shipyard on the White Sea laid the keel of the first Soviet nuclear submarine in early 1956 and the initial "November" class SSN was launched in 1958. Two years later the same yard launched the VMF's first SSBN, the "Hotel" class. This single shaft submarine was designed with three missile tubes arranged in a large sail.

The first generation nuclear plant installed in Hotel experienced extensive difficulties in safety and efficiency. These problems combined with overriding strategic policy considerations caused the limited construction of only ten submarines of this class between 1958 and 1962. Concurrent with SSBN production, as a hedge against failure of the new atomic technology, the Soviet Union developed the diesel powered "Golf" SSB. Somewhat smaller than Hotel, the Golf class SSB was similarly designed to carry three ballistic missiles in the sail. Powered by three engines, the Golf became operational in 1958, and by 1963, twenty-two of the class were on patrol or fitting out. [Ref. 4, 1963-64: p.424]

C. FIRST OPERATIONAL MISSILES

The missile which first deployed with the Golf and Hotel submarines was the SS-N-4 SARK (NATO designation). Requiring a surface launch, the liquid fuel SARK was a short range missile with a powerful one megaton nuclear warhead. It had been test-fired from the Zulu-V in 1955 but did not deploy operationally until 1958. [Ref. 17: p. 57]

Five years later, the VMF introduced the SS-N-5 SERB to the fleet, incorporating the significant improvement over its predecessor of submerged launch. SERB also doubled the range for Soviet SLBMs with a comparable payload. In all, seven Hotel and thirteen Golf boats were converted to launch the SS-N-5. Western analysts noted the conversions by designating SS-N-5 equipped subs as Golf II and Hotel II and SS-N-4 subs as Golf I and Hotel I.

D. FIRST TRUE STRATEGIC SSBN

It is highly likely that the Soviet Union had initiated a program for a new SSBN to be similar in appearance to the U.S. Ethan Allen class by 1957. [Ref. 11, 1981-82: p. 477] However, in January 1960, the Kremlin enunciated a new defense policy, shifting the majority of responsibility for strategic strike to the land-based Strategic Rocket Force (SRF). The shift caused a slow-down in new submarine programs and contributed to the limited number of Hotel class SSBN's built.

By the fall of 1961, the Soviets were able to discern that the Kennedy administration had embarked on a major across-the-board arms build-up, including accelerated SSBN procurement. In October of that year, the Twenty-second Communist Party Congress announced that it would respond in kind. [Ref. 14: pp. 34-35]

Early in the decade the shipyards at Severodvinsk and Komsomolsk in western Siberia were upgraded to build the new

"Yankee" class SSBN. Together, the yards could accommodate twelve hulls of the sixteen tube submarine and, when first reported in open sources in 1969, the Soviet Union was producing six to eight Yankees per year. With an end force level of 34, the new SSBN provided the Soviet Union with a true strategic strike system within operating range of the continental United States.

E. YANKEE MISSILES

The missile designed to be fired from the Yankee was the SS-N-6 Sawfly, a liquid fuel weapon with a range of about 1,300 nautical miles and submerged launch capability. In 1974 it was noted that modified Sawfly's had joined the fleet, including the 1,600 nautical mile Mark III with a three MRV warhead.

In 1977, the first Soviet solid fuel SLBM, the SS-N-17 was fitted out in a single Yankee (designated Yankee II), extending the operational range of that one platform by 800 nautical miles. [Ref. 11, 1980-81: p. 472]

The ranges of the Sawfly missiles in the other 33 boats necessitated long transits to reach patrol stations near the eastern and western seaboards of the United States.

F. DELTA

In 1972 the Soviets revealed a new SSBN class, designated "Delta" by NATO. Although only slightly larger in tonnage than Yankee, the new submarine provided a huge increase in

capability for the Soviet Union because of its missile's 4800 mile range. To accommodate the large missile, Delta presents an unusually high above-keel profile to house a pared down complement of twelve launchers. [Ref. 11, 1978-79: p. 487]

The SS-N-8 missile aboard Delta was further improved in 1976, extending its range to 5600 nautical miles and increasing its accuracy. An inertial guidance system with stellar correction capability achieved a warhead C.E.P. under 1,500 feet, giving Delta unprecedented accuracy and range, thus able to target all of the North American continent from home waters. [Ref. 8: p. 115]

G. IMPROVED DELTAS

In 1971, while Delta was still in production, the Soviets initiated a hybrid Delta II program. Increasing hull length by about 50 feet, the Delta II accommodates sixteen SS-N-8 missiles. Six years later, a second version of the same basic submarine became operational, the Delta III. About 2000 tons heavier than the Delta II, the latest series carries sixteen of the new SS-N-18 SLBM's.

The SS-N-18 is a two-stage, liquid fuel missile with three possible warheads. A single weapon version has been observed as well as post boost vehicles with three or seven MIRV's. Its improved accuracy and multiple warhead feature makes Delta III the most potent Soviet SSBN operational. [Ref. 18]

Between 1967 and 1979, Soviet shipyards completed 66 Yankee and Delta SSBN's, convincingly closing the gap in SLBM numbers with the United States. [Ref. 19: p. 8] Delta IIIs continue to be built today together with a new SSBN class.

H. TYPHOON

In 1979 a new design for Soviet SSBNs was revealed. Called "TAYFUN" (Typhoon) by the Kremlin, the submarine is the largest undersea craft in the world with a dived displacement of about 30,000 tons. First launched in September 1980 at the Severodvinsk Shipyard, Typhoon has twenty missile tubes forward of the sail, allowing space aft for two nuclear reactors.

Other characteristics of Typhoon provide evidence of revolutionary Soviet concepts in SSBN construction. A separation of thirteen to fifteen feet between the inner and outer hull enables resistance to torpedo hits. [Ref. 11, 1981-82: p. 131] The gap between hulls may have another purpose. Typhoon's hull rises high above the waterline when surfaced. Its sail has a stubby profile and the bow diving planes are retractable. These features, as well as the inner-outer hull cushion, could contribute to a submarine's ability to break through an ice pack and clear the missile deck of ice chunks to fire its missiles. If this is the purpose of Typhoon's unusual construction, SSBN's of its class could patrol under the Arctic ice cap, reducing

considerably the range to targets in North America over previous patrol areas. [Ref. 20: pp. 8-9]

In early 1980, a new solid fuel SLBM was tested. Longer than the SS-N-18, the missile, designated SS-NX-20, is presumed to be earmarked for Typhoon. It will probably incorporate MIRV technology and have a maximum range similar to SS-N-18. [Ref. 11, 1981-82: p. 762]

I. COMPARISONS AND ADDITIONAL INFORMATION

Table IV summarizes Soviet SLBM development. Only missiles which have reached the operational stage have been included. Generally, the missiles have consistently improved in accuracy and have extremely destructive warheads of one megaton or more. The Soviets appear to prefer liquid fuel engines for their SLBMs, which are generally more hazardous to maintain and operate than their solid fuel counterparts. Technological improvements of multiple and multiple independently targeted warheads are now part of Soviet SLBM development.

The SS-N-6, along with the Yankee platform, gave the Soviets their first real intercontinental undersea nuclear threat. The SS-N-8 enabled North American targeting from protected home waters. The SS-N-18 MIRV warheads are an important developmental stage for attainment of a counterforce capability.

Table V lists the myriad classes of Soviet SSB's, SSBN's and hybrids. Although the pace of construction has sometimes

been furious, qualitative progress in their submarines has been gradual. Typhoon may represent a true departure from submarine concepts as evidenced by its size and unusual design.

Power plants, dimensions, displacement tonnage and numbers of missiles have generally increased with introduction of each new submarine. Some consistencies in Soviet SSBNs include Snoop series search and navigation radars, either Snoop Plate or Snoop Tray; ELF/VLF transceiver communications gear with floating aerials; and bow array sonars.

Table VI lists the SLBM assets available to Soviet planners over the years. From the crude and extremely limited force capability in 1958, the Soviets underwent a huge build-up in the 1960s and 1970s. They relied upon large yield and throw weight for single warhead missiles rather than fewer platforms and more numerous smaller warheads as in the United States.

The SALT I accords signed in 1972 allowed the Soviets to continue rapid construction of SSBNs to reach the 62 submarine, 950 launcher limits. Although not counted in those restrictions, the boats armed with older missiles still provide the Soviets with short range theater capability.

The six Zulu V submarines were removed from operation between 1970 and 1977. One Golf has been modified to test launch the SS-N-8 and has been designated Golf III. Two other boats, the Golf IV and Golf V are test platforms for

SS-N-6 and other missiles. The remaining Golf I's may have had their missiles removed and serve as general purpose boats. [Ref. 11, 1980-81: p. 474] The Golf IIs serve in theater forces in the Baltic and Pacific. [Ref. 11, 1981-82: p. 479]

A single Hotel has been extensively modified to launch six SS-N-8 missiles from an enlarged sail and is designated Hotel III. This submarine is included in SALT I force levels. The disposition of other Hotels is largely unknown. [Ref. 11, 1981-82: p. 478]

As the Soviets have completed new Delta submarines, they have removed the missile tubes from Yankees to adhere to SALT limits. As of 1982, they have pared their Yankee force level to twenty-nine. Of the remaining boats of this class, one is armed with the SS-N-17, eighteen with the MRV mod. of the Sawfly and the remainder with the single warhead SS-N-6. [Ref. 11, 1980-81: p. 472]

The 1982 Soviet Order of Battle included one Hotel III, twenty-nine Yankees, eighteen Delta I's, four Delta II's, twelve Delta III's and one Typhoon, which is undergoing sea trials. Dr. Donald Daniel of the Naval Postgraduate School has speculated that the Soviet Union is slowing its missile submarine acquisition rate in favor of general purpose forces. Although SALT may be a factor in slowed construction rates, an inventory increase of over 700% in the last decade may be deemed adequate for Soviet security by Soviet planners. [Ref. 21: pp. 71-72]

Soviet SSBN and SLBM development has been gradual and steady, with continuing increases in capability and numbers. One of many approaches to problems of national security and support of Kremlin foreign policies, the FBM force is a consistent relfection of expansion of Soviet power and global interests.

TABLE IV

SOVIET SUBMARINE-LAUNCHED BALLISTIC MISSILES

MISSILE	DESCRIPTION	DATE FIRST DEPLOYED	LENGTH (FEET)	WEIGHT (POUNDS)	RANGE (NAUTICAL MILES)	WARHEAD DESCRIPTION	ACCURACY: C.E.P.[1] IN NAUTICAL MILES
SS-N-4 SARK	Single-Stage Liquid Fuel	1958	43	41,000	370	Single 1-2 Megaton	1.5
SS-N-5 SERB	Single-Stage Liquid Fuel	1963	43	41,000	900	Single 3.5 Megaton	1.5
SS-N-6 SAWFLY (3 Mods.)	Single & Two-Stage Liquid Fuel	1967	32	44,000	1300-1600	Single 1.5 Megaton & MRV on Mod. 3	.5-1.25
SS-N-8	Two-Stage Liquid Fuel	1972	42	45,000	4800	Single 1.5 Megaton	.5
SS-N-17	Two-Stage Solid Fuel	1977	36	?	2400	Single 1.5 Megaton	.4
SS-N-18	Two-Stage Post Boost Vehicle Liquid Fuel	1978	46	?	4200-4500	Single, 3 and 7 MIRV Versions .5-1.5 Megaton	.35

[1] C.E.P. = Circular error probability.

[Refs. 4, 9, 11]

TABLE V

SOVIET BALLISTIC MISSILE SUBMARINES

CLASS (WESTERN DESIGNATIONS)	PROPULSION	NUMBER BUILT/ CONVERTED	DIMENSIONS (LENGTH/BEAM/DRAFT)	DISPLACEMENT (SURF/DIVED)	SPEED (KTS) (SURF/DIVED)	MISSILE SYSTEMS	TORPEDO SYSTEMS
Zulu V	Diesel 10000 BHP	/6	295/29/17	2100/2600	22/16	2 x SS-N-4	8 x 21"
Golf I	Diesel 6000 BHP	22/	320/25/22	2350/2800	18/17	3 x SS-N-4	10 x 21"
Hotel I	Nuclear 22500 SHP	10/	377/28/25	3700/4100	?/20	3 x SS-N-4	6 x 21" 4 x 16"
Golf II	Diesel 6000 BHP	/13	320/25/22	2350/2800	18/17	3 x SS-N-5	10 x 21"
Hotel II	Nuclear 22500 SHP	/7	377/33/25	3700/4100	?/20	3 x SS-N-5	6 x 21" 4 x 16"
Yankee	Nuclear 24000 SHP	34/	426/35/33	8000/9000	20/25	16 x SS-N-6	8 x 21"
Hotel III	Nuclear 22500 SHP	/1	377/33/25	3700/4100	?/20	6 x SS-N-8	6 x 21"
Golf III	Diesel 6000 BHP	/1	320/25/22	3700/4100	18/17	3 x SS-N-8	10 x 21"
Yankee II	Nuclear 24000 SHP	/1	426/35/33	8000/9000	20/25	16 SS-N-17	8 x 21"
Delta I	Nuclear 60000 SHP	18/	450/35/33	8500/10000	20/25	12 x SS-N-8	6 x 21"
Delta II	Nuclear 60000 SHP	4/	500/36/34	9600/11400	?/25	16 x SS-N-8	6 x 21"
Delta III	Nuclear 60000 SHP	12/	509/40/33	11000/13250	?/24	16 x SS-N-18	6 x 21"
Typhoon	Nuclear 120000 SHP	1+/	600/75/?	? /25000	?/24	20 x SS-Nx-20	6 or 8 x 21"

[Refs. 4, 9, 11]

TABLE VI

SOVIET UNDERSEA STRATEGIC CAPABILITIES BY YEAR

YEAR	TOTAL SSB/ SSBNS	TOTAL LAUNCHERS	TOTAL WARHEADS OR INDEPENDENTLY TARGETED VEHICLES	OPERATIONAL RANGE (NAUTICAL MILES)	CAPABILITIES
1958	1	2	2	370	Sark Missile
9	3	6	6		
1960	4	8	8		
1	5	10	10		
2	12	30	30		
3	28	78	78	370-900	Serb Missile
4	34	96	96		
5	38	108	108		
6	38	108	108		
7	40	140	140	370-1600	SS-N-6
8	42	172	172		
9	44	204	204		
1970	46	224	224		
1	47	266	266		
2[1]	20	312	312	1300-4800	SS-N-8
3	28	436	436		
4	40	610	610		MRV on SS-N-6
5	42	634	634		
6	47	702	702		
7	54	794	794		SS-N-17
8	60	890	>1180		SS-N-18 MIRV
9	64	942	>1200		
1980	64	942	>1200		
1	64	942	>1200		
2	64	942	>1200		

[Refs. 4, 9, 11]

[1] In 1972, under provisions of the SALT I accords, all SS-N-4 and some SS-N-5 equipped submarines were not considered strategic delivery vehicles because of limited ranges. Although this apparent reduction in force levels is artificial, it serves to more accurately reflect Soviet capability to strike the U.S. with SLBMs. Therefore, after 1971, the chart counts only Y, YII, DI, DII, DIII, and HIII.

IV. OPERATIONAL CONSIDERATIONS

A. INTRODUCTION

Quality of construction and technology is a major determining factor of weapon system effectiveness. However, additional measures of effectiveness include systems employment doctrine which exploit advantages and overcome hardware deficiencies. Thus, operational considerations of U.S. and Soviet SSBN employment are traced, specifically regarding personnel and training, basing and support, patrol practices and communications.

B. UNITED STATES

1. Personnel

United States SSBNs are manned by about fifteen officers and 125 enlisted men. Personnel selected for submarine duty are carefully screened for mental, psychological and physical ability to withstand what is considered challenging and stressful duty. Training is extensive, covering a wide range of SSBN systems including the science of nuclear power. Men who "qualify" as submariners have thorough knowledge of virtually all essential submarine and weapon systems, resulting in redundant capabilities of a crew member to fill a number of warfare positions aboard the boat. [Ref. 22]

Two complete crews are assigned to each SSBN, designated Blue and Gold. They relieve one another on a schedule of approximately every three months and the evolution requires two to three days. The off-duty crew maintains proficiency through extensive refresher and cross-training. [Ref. 13: pp. 14-15]

2. Basing and Support

Polaris SSBNs were administratively assigned to Groton, Connecticut; Charleston, South Carolina; King's Bay, Georgia; and Pearl Harbor, Hawaii. Forward basing with support tenders (AS) was established at Rota, Spain; Apra Harbor, Guam; and Holy Loch, Scotland. With the introduction of the long range Trident I missile to the fleet, the Rota site was vacated in 1979 and Guam in 1980. Poseidon boats continue to deploy from Holy Loch. [Ref. 23]

The new Trident submarine base at Bangor, Washington was completed and turned over to the fleet in July 1981. Construction at King's Bay to support an additional squadron of Ohio class SSBNs is scheduled for completion in 1989. [Ref. 12, pp. 3-7]

Pre-Ohio class SSBNs require a 32 day refit after 70 days of operational patrol. A major 16 month overhaul is accomplished every six years. The Ohio and its successors are expected to increase SSBN at-sea time by 21%. Seventy day patrols will follow twenty-five day refits and major overhaul will occur at approximately nine year intervals. [Ref. 11, 1981-82: pp. 617-618; Ref. 24: p. 43]

3. Patrols

The patrol routine of U.S. SSBNs is tedious. Submerging soon after leaving port, they proceed to station somewhere well off the shipping lanes and hover at a depth of about 100 to 200 feet. The boats make little headway while on station and trail a communications antenna on or near the surface. Since 1975, Poseidon SSBN's have interrupted their on-station periods with mid-patrol port visits. [Ref. 22]

The U.S. Navy maintains 50 to 55% of its SSBNs on patrol at any one time. [Ref. 25: pp. 63-69] Because of their mobility, submarines give their medium range missiles an intercontinental capability. No point on earth is more than 2,000 miles from the sea and a submarine with 2,900 nautical mile missiles is within range of every conceivable target. [Ref. 26: p. 73]

Polaris and Poseidon patrols have been conducted in the Arctic, Atlantic and Pacific Oceans and the Mediterranean Sea. Trident I equipped boats can cover their targets from patrols closer to home waters. [Ref. 7: pp. 20-21]

Figure 1 depicts the operational sea areas from which SLBMs could hit Soviet targets, assuming Moscow as the central focus of attention. Figure 2 depicts sea areas within targeting of major population centers and industrial complexes within 200 miles of the Soviet border. The solid areas depict operational range patrol areas of a Polaris missile

Figure 1. Potential U.S. SSBN Patrol Areas: Centered on Moscow

[Ref. 27]

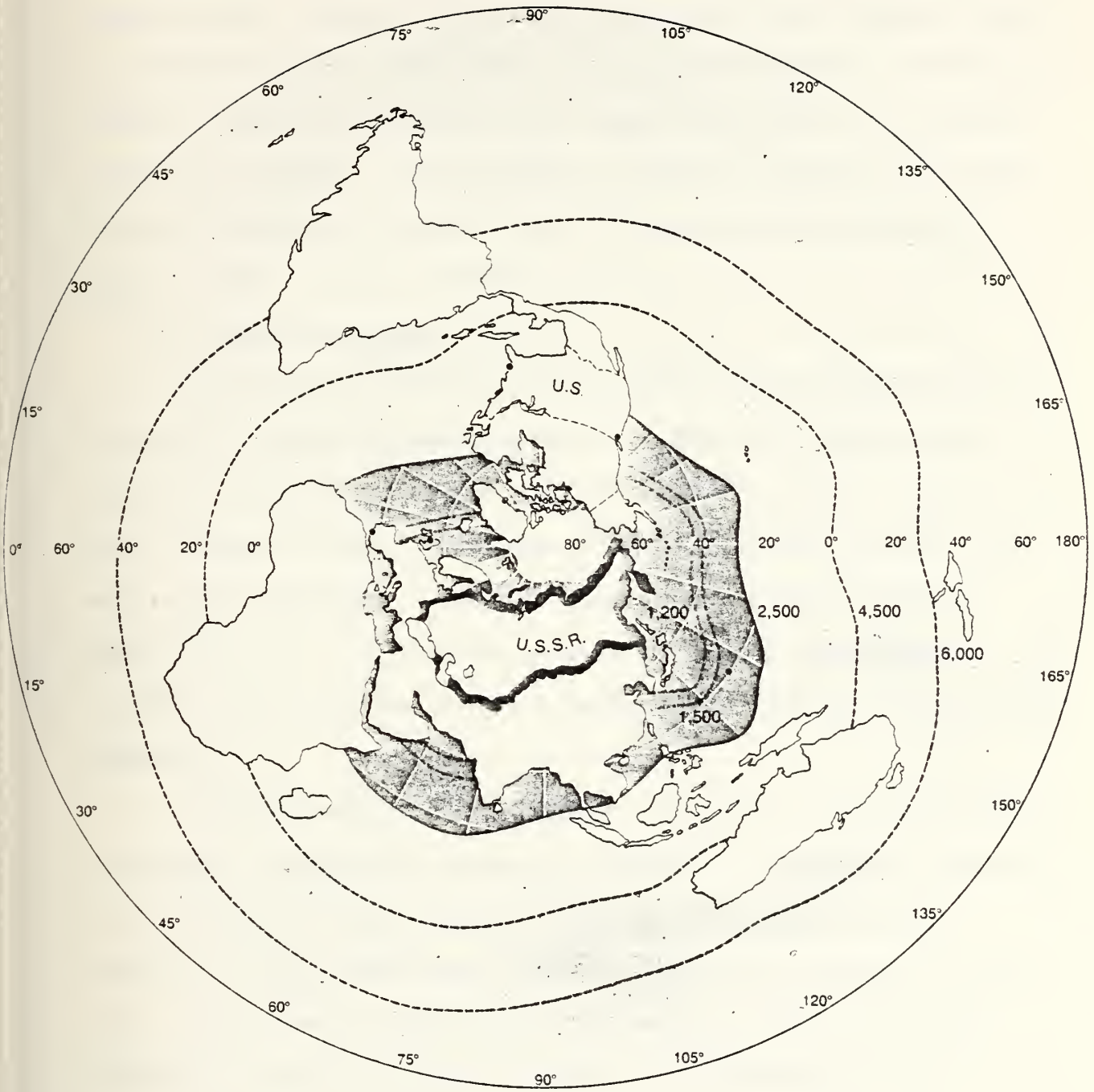

Figure 2. Potential U.S. SSBN Patrol Areas: Centered on Industry

[Ref. 27]

equipped boat. The outer lines define possible patrol areas of Poseidon and Trident I and projected Trident II missiles respectively. Black dots denote home ports and forward bases of the FBM fleet. The direct relationship between increasing missile range and potential sea areas from which to conduct patrols is evident. The Trident I missile allows a fourteen million square mile patrol area to remain within targeting range. [Ref. 28: pp. 36-39]

4. Communications

Maintaining secure and reliable communications with strategic forces is a particularly difficult problem for national leaderships. The problem is particularly acute with SSBNs because of the requirement to communicate through two media, air and water, and the desire to maintain stealth. [Ref. 29: p. 8] To provide effective nuclear deterrence, the FBM force must be able to respond immediately to a launch command.

The communications network which has been established to ensure a responsive strategic force is necessarily complex and redundant. The primary system for transmitting the Emergency Action Messages (EAM) to SSBNs is a network of six very low frequency (VLF) stations based on land. The submarines on patrol are able to copy a VLF message via a trailing antenna or buoy while submerged and monitor their VLF circuits continuously. If communications are broken, the boats are required to surface and establish reception

on back-up high frequency (HF), ultra-high frequency (UHF) or low frequency (LF) radios. [Ref. 30]

Providing further communications capability, the Navy maintains C-130 "TACAMO" aircraft airborne on a continuous basis. Equipped with several VLF radios, the TACAMO planes can relay messages from elements of the National Military Command System to the SSBNs should the primary system fail. [Ref. 31: p. 6]

Other recent improvements to the strategic communications network include hardening of the VLF stations against overpressure and rapid data transfer capability in two-way satellite transmissions.

A proposed Extremely Low Frequency (ELF) system could further enhance communications reliability. The ELF's long wave length is resistant to degradation in a nuclear environment and can penetrate water twenty times deeper than VLF. [Ref. 31: p. 3] The controversial system has not yet been approved for construction.

C. SOVIET UNION

1. Personnel

Complements for Soviet SSBN's are 86 officers and men aboard Golfs, 90 in Hotels, 120 in Yankees and Deltas and about 150 aboard Typhoon. [Ref. 32: pp. 212-215] One crew is assigned to each submarine.

Most enlisted men in Soviet SSBNs are three year conscripts. The few who are retained beyond their initial

tour usually attain the rank of warrant officer (the equivalent of American E-6 or E-7).

Officers serve very lengthy tours, usually aboard the same submarine. Almost all are graduates of the Leninsky Komsomol Higher Naval School of Submarine Navigation in Leningrad, one of eleven Soviet schools which are the rough equivalent of the U.S. Naval Academy. [Ref. 14: p. 39]

Submariners are the elite of the Soviet Navy and a special initiation ceremony is meant to instill a sense of distinction and pride in the most prestigious arm of the VMF. Few professional officers leave the submarine community for other types of duty. [Ref. 33: p. 108]

2. Basing and Support

Soviet SSBNs are home ported at the three major bases of Severomorsk near Murmansk, Petropavlosk on the Kamchatka Peninsula and Vladivostock on the Sea of Japan.

The 1981 Jane's Fighting Ships listed 46 SSBNs assigned to the Northern Fleet and 24 to the Pacific Fleet. Of the Golf SSB's, five were in the Northern, six in the Baltic (since 1976), and eight in the Pacific Fleets. [Ref. 11, 1981-82: p. 470]

Soviet SSBN's spend the vast majority of their time pierside. Regular maintenance is therefore easily completed during long in-port periods. Major overhaul is conducted about every eight to nine years and requires up to thirty-six months in the shipyard.

3. Patrols

An average of only 15% of Soviet SSBNs are on patrol or at sea at any one time. [Ref. 23: p. 27] It is believed, however, that during a war or in an immediate pre-war period, the VMF would sortie all SSBNs and SSBs able to put to sea to avoid destruction and await orders. [Ref. 21: p. 77]

Golf and Hotel submarines, with their limited range missiles, patrol coastal waters and contiguous seas in a theater strike role. [Ref. 11, 1981-82: p. 479]

Sawfly-equipped Yankee SSBN's brought the SLBM threat directly to the United States homeland, patrolling waters near the east and west coasts of the North American continent (and Asia) since 1971. [Ref. 34: p. 32] Throughout the 1970s, the Soviets maintained three Yankees in the western Atlantic, one in western Pacific and one in the eastern Pacific. [Ref. 35: p. 205] To bring their missiles within range of coastal and inland targets of the United States required long transits in open ocean, expending as much as one third of a patrol's duration or six to eight days steaming to and from station. [Ref. 6: p. 24]

Deltas are within range of North American targets from home waters at Murmansk and Petropavlovsk and they patrol in limited protected areas of the North Pacific and Barents Sea. [Ref. 36: p. 63] As Deltas have entered the operational fleet, Yankees have probably been drawn back from forward areas for theater or tactical strike missions. [Ref. 15: p. 148]

Figure 3 depicts the operational sea areas from which SLBMs could hit targets anywhere in the United States. Figure 4 displays increased flexibility afforded by targeting only within 200 miles of the U.S. borders. Alaska and Hawaii are excluded from consideration. The solid areas represent Yankee missile ranges and, the outer broken lines, the increase in patrol area flexibility of follow on ballistic missiles for Delta. As previously mentioned, the Soviets do not take advantage of increased patrol areas afforded by better missile ranges, opting rather to maintain their Deltas in contiguous waters.

4. Communications

Soviet naval communications are based on a series of redundant and reliable systems which ensure secure links with all operational units including SSBNs. The network includes VLF stations, land lines, satellite relays and HF transmitters. Secure communications enable strict and direct control over the FBM force by the High Command or STAVKA. [Ref. 35: p. 59]

Control over ballistic missile submarines which remain close to the homeland such as Golf, Hotel and Delta do not present great difficulties for communications networks. Relatively short range and low power systems are adequate for limited patrols.

When Yankees patrol in forward stations, it is assumed that communications are accomplished using transfer

Figure 3. Potential Soviet SSBN Patrol Areas: Targeting the the United States

[Ref. 27]

Figure 4. Potential Soviet SSBN Patrol Areas: Targeting Coastal United States

[Ref. 27]

links from Moscow such as long range Bear reconnaissance aircraft, intelligence gathering ships or A.G.I.'s and land-based transmitters in Cuba.

D. CONCLUSION

Differences in U.S. and Soviet SSBN operational practices reflect divergent capabilities and military priorities. Similarities in quality of personnel and communications procedures and redundancy indicate some constancy in the demands and challenges unique to operating submarine ballistic missile systems.

V. THE SSBN IN UNITED STATES STRATEGIC DOCTRINE

A. INTRODUCTION

To date, undersea strategic nuclear forces have been available to seven United States administrations. Throughout that time SSBN and SLBM technology and capabilities have evolved and improved. The public doctrine which governs the purpose and employment of U.S. strategic forces in general, and the submarine arm of those forces specifically, has also evolved through various presidencies. Usually, a change in administration has marked a fresh look at nuclear doctrine, an assessment of effectiveness of past policies, and promulgation of new approaches in future national security and defense. The evolution of American strategic doctrine is, therefore, usefully divided into eras of presidential leadership, documented by the cabinet officers who enunciated policy.

Each administration's doctrine is examined for announced strategic objectives and general policy governing nuclear forces and defense, and the stated position or purpose of SSBNs in attaining the objectives. Specific issues which elucidate the contribution of the submarine ballistic missile force to national security policies are total force levels; current and planned technology and weapons capabilities (warhead yield, range and accuracy); and targeting and

operational assignment, which reflect both force levels and capabilities.

B. 'STRATEGIC DOCTRINE' DEFINED

In American parlance, strategic doctrine refers to policy which governs objectives and plans of employment of nuclear weapons.[1] As in the case of U.S. SLBM's, both theater or regional and intercontinental general forces would fall under the direction and guidance of American strategic doctrine.

C. U.S. DOCTRINE AND DETERRENCE

The primary goal of United States strategic doctrine has consistently been deterrence. The success of a deterrence strategy depends on the ability to convince an adversary that to attempt to gain a particular objective would cost more than its worth. Concurrently, the cost to the deterrer (the United States in this case) of applying the deterrent (strategic forces) must appear to be less than conceding the objective sought by the adversary. Implicit in the calculus of deterrence cost-benefit is the credibility of the threat to use military forces to achieve or deny achievement of objectives and a rational adversary who is fully informed and understands one's own commitment to concede or deny an objective. [Ref. 37: p. 33]

---

[1]The semantic rule, strategic = nuclear, applies uniquely to American usage of the terms.

The American understanding of deterrence produces a doctrine which is defense-oriented, that is, prepared to fight should deterrence fail, but reluctant to strike a first nuclear blow. Thus, the primary attribute required of any deterrent force is the ability to survive a first strike by the enemy. [Ref. 6: p. 15] Most of the evolution of U.S. strategic doctrine can be attributed to the refinement of response possibilities to a first strike by the Soviet Union.

D. EISENHOWER

1. Doctrine and Policy

The Report by the Secretaries of State and Defense on 'United States Objectives and Programs for National Security' of April 7, 1950, better known by its serial number, NSC-68, was a call to arms. Warning of dark Soviet intentions, it urged that the United States assume a leadership position in the Free World, build up its nuclear and general purpose forces, and thwart the huge threat posed by the expansion-minded Kremlin leadership. [Ref. 25: p. 58]

By 1953, President Eisenhower's Secretary of State, John Foster Dulles, was articulating a "New Look" policy, with emphasis on defense through nuclear weapons at the expense of conventional forces. The administration was preparing the nation for a long term confrontation with the Soviet Union, and thus, sought defense solutions which were effective but affordable. The weapons effectiveness standard of "maximum deterrent at a bearable cost" would be fulfilled

by nuclear force levels sufficient to deter Soviet aggression by "...a great capacity to retaliate, instantly..." Although the threat of a massive retaliatory attack provided the ultimate deterrent, Eisenhower and Dulles sought the ability to respond to aggression "...by means and at places of our choosing," that is, selectively, should deterrence fail. [Ref. 38]

The bulk of the administration's deterrent and retaliatory capability was provided by the long range bomber force of the Strategic Air Command. [Ref. 25: pp. 58-59] However, in the mid-1950's research and development was ongoing for alternative weapons and delivery vehicles, including the submarine-launched ballistic missile.

In August 1957, the Soviet Union first flight tested an ICBM. In October of that year Sputnik was launched into orbit and Sputnik II followed in November. Also in 1957, Rowan Gaither, head of the Ford Foundation, submitted a secret report to the National Security Council warning of advances in Soviet strategic capability. He stated that by 1959, the Soviet Union would possess 100 ICBM's and the capability to launch a nuclear strike on the United States.

President Eisenhower, however, had obtained intelligence provided by U-2 aircraft photos which indicated that the Soviet Union had halted ICBM tests after the initial firing in 1957. He rejected Gaither's call for a massive fallout shelter program and warnings of a potential "missile gap" of Soviet superiority by 1962. [Ref. 39: pp. 90-91]

The public and the Congress did not share the President's knowledge or confidence. Twice in the late 1950's, the Democratic-controlled Congress appropriated several hundred million dollars more for construction of Polaris submarines than Eisenhower requested. [Ref. 1, pp. 8-9] The SLBM's were a particularly attractive weapons system under circumstances of a Soviet threat because of their ability to survive a surprise attack and retaliate. [Ref. 25: pp. 58-59]

The administration did, in fact, respond to the Soviet threat, but in a deliberate manner. Eisenhower formed the National Aeronautics and Space Administration (NASA) to compete with Soviet achievements in space. He supported the better second generation Polaris and Minutemen missiles over their liquid fuel predecessors. [Ref. 39: pp. 90-91] Eisenhower also approved termination of the Regulus air breathing missile program in favor of the more promising ballistic technology. [Ref. 40: p. 162]

To command and control new strategic forces which expanded beyond exclusive Air Force purview, President Eisenhower formed the Joint Strategic Target Planning Staff to coordinate nuclear targeting. The Air Force commander of the Strategic Air Command was assigned to head the staff with a Navy flag officer as his deputy. One of their duties was to prepare the Single Integrated Operational Plan, or SIOP, which operationally controls and directs all U.S. strategic forces.

2. Force Level

In February and April of 1958, construction was approved for five ballistic missile submarines. The Washington class SSBNs and their successors began to conduct operational patrols in Eisenhower's final year in office. By the end of 1960 two SSBNs were at sea armed with 32 A-1 missiles. As new members of the American strategic forces, the submarines helped to fulfill the Defense Department's two-fold objectives for national security: "...to deter the outbreak of a major war by defending the home base and striking back decisively against any aggressor...," and "...to prevent or contain local wars by being ready to come to the aid of threatened friendly nations, if necessary..." [Ref. 41: p. 1]

3. Technology

Although its range was limited to about 1200 nautical miles, the A-1 missile's submarine launch platform's mobility gave it an intercontinental capability. However, Polaris' most attractive characteristic was its invulnerability due to underwater launch. Its retaliatory capability was assured and was, therefore, an effective deterrent as a survivable threat of assured destruction. [Ref. 42: p. 144] Further, the SSBN could reach its targets without reliance on forward stations. The Secretary of the Navy reported in 1958: "...the fleet ballistic missile system will provide a practically invulnerable retaliatory weapon, independent of foreign bases." [Ref. 41: p. 220]

4. Targeting and Assignment

The A1's one megaton warhead with an accuracy of one to two miles limited its possible targeting assignment to sprawling industrial or population centers. Such an assignment seems crude but would have been effective in a strategy based on massive retaliation. The Eisenhower administration was, however, dedicated to further refinement of FBM technology and had created the means in the S.I.O.P. to incorporate more sophisticated capabilities into operational plans.

E. KENNEDY

1. Doctrine and Policy

One of the Congressmen who charged President Eisenhower with not adequately addressing the alleged missile gap was Senator John F. Kennedy from Massachusetts. He predicted: "The deterrent ratio during 1960-1964 will in all likelihood be weighted against us." [Ref. 39: p. 90]

Kennedy continued to harp on the U.S. strategic forces as a presidential campaign issue. When he assumed office in the White House in January 1961, he was determined to correct what he viewed as two fundamental flaws in the nation's military posture: the inadequacies of both strategic deterrent and conventional capabilities. [Ref. 43: p. 78] Kennedy's newly appointed Defense Secretary, Robert A. McNamara, reiterated Eisenhower's knowledge of the

fallacy of the missile gap, yet the President persisted in his goals of across-the board military build-up. [Ref. 39: p. 111]

Kennedy formulated his strategic doctrine and plans based on the writings of General Maxwell D. Taylor. In The Uncertain Trumpet, [Ref. 44] Tayler outlined a national military program of "Flexible Response" and rejected the strategy of Massive Retaliation. Eisenhower's doctrine had not advocated a general nuclear exchange in response to any contingency. Nevertheless, Taylor saw inadequacies in excessive reliance on nuclear weapons for national defense. There were limitations in atomic deterrent forces and Taylor urged preparation for more limited forms of conflict.

In a speech given at Ann Arbor, Michigan in 1962, Defense Secretary McNamara articulated one of two primary objectives in the administration's flexible response strategy. He stated that there would be a continuing dedication to a 'no first strike' capability and that the targets of the retaliatory strike would be limited to military forces only, the so-called 'no cities' doctrine. Thus, the strategic objective of 'counterforce' targeting was revealed to the public.

During Congressional testimony, McNamara outlined his second major strategic objective. He stated that the administration would pursue "...a meaningful capability to limit the damage of a determined enemy attack..." by building

"...an integrated, balanced combination of strategic offensive forces, area defense forces, terminal defense forces and passive defenses." [Ref. 45; 46]

The administration hoped that counterforce targeting would encourage the Soviets to seek similar objectives. A highly survivable retaliatory strategic force would contribute to deterrence and more balanced conventional and tactical nuclear forces would allow a range of options in situations short of a general exchange.

2. Force Level

To achieve flexible options across the entire spectrum of conflict, President Kennedy rejected Eisenhower's force level philosophy of sufficiency. For the early 1960's, the United States would seek superiority in strategic arms.

The administration's first step toward increasing strategic capabilities was to accelerate the existing Polaris program by two years. [Ref. 47: p. 8]

In January 1961, there were two SSBNs on patrol and twelve more under construction or fitting out. Kennedy immediately ordered five additional boats and requested funds for ten more. The proposed end force level of a 45 SSBN fleet was projected by the end of the decade. In 1962, Secretary McNamara cut this plan to 41 boats and 656 launchers, reflecting a reported desire for balanced modernization and new construction in conventional weapon systems. [Ref. 2: pp. 42-56]

3. Technology

SLBM technology available in 1961 did not contribute significantly to a selective counterforce targeting doctrine. A study conducted that year by the Net Evaluation Sub-Committee of the National Security Council concluded that the entire strategic force was inadequate for the counterforce objective Among other improvements, it recommended the development of improved C.E.P.s and a variety of yield options for SLBM warheads. [Ref. 48: pp. 12-13]

Missiles available to the Kennedy administration were the Polaris A-1 and A-2 with one megaton warheads, accurate to two miles. It is not likely that such a weapon would limit peripheral damage adequately for a clearly counterforce targeting plan.

4. Targeting and Assignment

During the early 1960s, discussions of Polaris capabilities did not emphasize accuracy. Rather, those qualities which were touted included survivability and reliability for second strike. Admiral Burke testified: "These characteristics guarantee inevitable retaliation to the enemy, should he mount a surprise attack." [Ref. 49: p. 898]

By default, then, the FBM force's function under Kennedy continued to be a countervalue urban-centers strike platform. While the Strategic Air Command held responsibilities for surgical counterforce strikes, the Navy's Polaris force provided the ultimate deterrent, an invulnerable assured destruction back-up. [Ref. 48: pp. 39-40; Ref. 37: p. 243]

The 1960 SIOP inherited by Kennedy's planners called for a single large nuclear strike, the so-called massive retaliation of the Eisenhower administration. Changes made to the plan in 1962 were indicative of further refinement of the SSBN role in strategic plans. The concept of a reserve force, withheld from an initial nuclear exchange, to contribute to intra-war deterrence, was developed. [Ref. 50: p. 97] Survivability of the SLBM's ensured inclusion in such a role. Flexible response was to be applicable not only to all-types of conflict but also to various stages of conflict escalation. It was possible that a pause might follow a counterforce second strike during which further enemy aggression could be deterred by the U.S. capability to selectively spare or destroy urban and industrial centers with Polaris missiles. [Ref. 51]

F. JOHNSON

1. Doctrine and Policy

Lyndon Johnson assumed the Presidency in November 1963. The continuation of Robert McNamara as Defense Secretary ensured some continuity in policy and strategic doctrine.

The momentum of the Kennedy arms build-up carried over after his death. From 1961 to June 1964, the number of warheads in the strategic alert force increased 150%; number of bombers, 50%; and the number of combat divisions, 45%. [Ref. 52: p. 3] In 1964, SSBN production reached its

zenith with twelve boats commissioned that year. [Ref. 2: p. 56]

By 1965, events were overtaking McNamara's commitment to counterforce targeting, damage limitation and force superiority. The growing conventional arms costs of Vietnam diverted potential funds for strategic systems. The Soviet Union had also launched its own across-the-board arms build-up, presenting an increasingly serious challenge to both damage limitation defenses and American surperiority in offensive systems.

Although declaratory policy from 1964 through 1966 included damage limitation as a basic strategic objective, during that time McNamara began to privately advocate an assured destruction deterrence strategy. Expanding Soviet capabilities served to reciprocate the threat to entire societies, thus necessitating the term, "Mutual Assured Destruction."

Desmond Ball cites four reasons for McNamara's abandonment of counterforce strategy [Ref. 48: pp. 15-16]: First, counterforce targeting was criticized in the United States for its first strike implications. To destroy the enemy's offensive capability requires striking silos with missiles still in them; hence, first strike. Second, in public statements, the Soviets doubted that conflict could be controlled as suggested in a flexible response strategy and, therefore, any response by their forces would be general,

targeting military and civilian population centers. Third, to the European allies of NATO, a counterforce "no cities" doctrine implied a renunciation of the assured destruction deterrence strategy which threatened all of Soviet society. It was a doctrine which, to them, weakened the U.S. nuclear guarantee of their territorial integrity. Fourth, the cost of obtaining a force of adequate numbers and accuracy for survivable counterforce, and adequate defenses against enemy strategic systems, was prohibitive, especially with the competing economic demands in Southeast Asia.

2. Force Level

The resultant M.A.D. strategic policy marked the abandonment of both counterforce offensive and damage limiting defensive capabilities. The United States unilaterally halted further deployment of strategic weapons after 1967, freezing force levels at 1054 ICBMs, several hundred B-52 bombers and 41 ballistic missile submarines with 656 launchers. The force level objective of "sufficiency" again replaced superiority. It was hoped that the Soviet Union would reciprocate, enhancing an environment of cooperation, leading to arms limitations negotiations, and maintaining a stable stalemate of Mutual Assured Destruction. [Ref. 53: p. 370] While American forces remained constant for the next thirteen years, the Soviets continued to build offensive forces.

3. Technology

During Johnson's administration the MRV Polaris A-3 missiles became operational, improving the deployed SLBM force's penetration capability against Soviet anti-ballistic missile systems. This development enhanced the FBM force as an assured destruction reserve deterrent. However, ongoing research and development created debate within government circles about the future role of SLBM's in U.S. strategy.

Follow-on warhead technology to the Polaris was progressing in the mid-1950s. As a next step to MRV capability, independently targeted warheads or MIRVs were test-launched from single bus stages. The new warheads could not only exasperate anti-missile defenses, but also potentially knock out hardened "time urgent" targets such as missile silos with the combination of multiple hits and requisite accuracy. Thus, Poseidon developmental goals followed two tracks, to be effective against soft urban/industrial targets and hardened counterforce sites. The dual purpose nature of Poseidon was a closely kept secret within the Administration, however, because of McNamara's public commitment to abandonment of counterforce capability. [Ref. 1: pp. 220-221]

4. Targeting and Assignment

The SIOP remained unchanged during the Johnson administration, although the pure counterforce option was considered of less value. Rather, the countervalue portions of the plan received greater emphasis. [Ref. 48: pp. 16-17]

The Polaris force's unimproved standing in capability reinforced its position as a reserve urban-industrial targeted deterrent and bolstered McNamara's revised doctrine. In the report to Congress on the Fiscal Year 1969 Defense Budget, he praised Polaris' contribution to an Assured Destruction strategy because of inherent survivability, enabled by high mobility and concealment. [Ref. 54: p. 43] McNamara expressed confidence that even in worst case scenarios of massive surprise attack, adequate SLBMs would survive to deliver a devastating blow, estimated to destroy 1/5 to 1/4 of the Soviet population and 1/2 of its industrial capacity. [Ref. 54: p. 50] Further, McNamara publicly assessed future FBM capabilities with introduction of Poseidon to the fleet as increased penetration capability and survivability, not enhanced counterforce features. [Ref. 54: p. 59]

G. NIXON

1. Doctrine and Policy

During the 1968 Presidential campaign, Richard Nixon demanded that the United States return to a position of nuclear superiority over the Soviet Union. However, when he took office, it was clear that sufficiency would remain the force levels goal during his administration. Superiority, he said, was an inappropriate approach to the problem of national security. [Ref. 48: p. 5]

The President, and his Defense Secretary, Melvin Laird, defined sufficiency as enough military force to deter an all-out surprise attack with adequate second strike capability; to provide no incentive, through perceived U.S. weakness, for the Soviets to launch a first strike in a crisis; to prevent Soviet superiority in urban/industrial destruction capability; and to defend against damage from small attacks or accidental launches. [Ref. 55: p. 62]

Laird's key concept in defense planning was "Realistic Deterrence," which would discourage and ultimately eliminate the use of military force as a foreign policy tool. To achieve his goals, 'Total Force Planning' which realized a realistic mixture of military forces, and 'Net Assessment,' which accounted for all factors of national power - military, technological, political and economic - would be the analytical tools to arrive at sufficient force levels. [Ref. 56]

Defense Secretary James Schlesinger, appointed in 1973, reaffirmed the administration's commitment to the assured destruction (AD) capability. He stressed, however, that the countervalue implication of AD was to be only one of many options. Further, not only could the threat of AD serve as the ultimate, doomsday deterrent, but the option might also contribute to an intra-war deterrent situation. An invulnerable reserve force could aid in focusing Soviet attention on the risk of widening an ongoing conflict. [Ref. 25: p. 65]

Schlesinger thus expanded U.S. strategic objectives to include "limited strategic options," the capability to control nuclear exchanges through survivable communications, retargetable weapons tailored to changing scenarios and contingencies, and sufficient accuracy and precision in nuclear strikes to ensure minimum civilian fatalities. Limited options implied an extended war-fighting capability, and control of escalation throughout a conflict with deliberate and selective counterforce strikes.

A third element of the Schlesinger Doctrine was the commitment to force levels reflecting "essential equivalence" with the Soviet Union. This translated into the minimum objective of a perceived parity with the Soviets in strategic capabilities, in order to maintain a credible deterrent in the eyes of the European allies and Kremlin leadership. [Ref. 57]

The budgetary impact of nuclear sufficiency and essential equivalence was austerity. [Ref. 58: p. 2] The primary military concerns of the Nixon administration were the Vietnamization of the Southeast Asian conflict and the completion of the SALT accords with the Soviet Union. Current strategic force levels were adequate at all levels of potential conflict and defense against a Soviet offensive strike was deemed essentially futile. [Ref. 56: p. 5]

2. Force Level

In the atmosphere of budget austerity and mutual arms limitations, the SLBM force level remained frozen at 656 launchers. The SALT I agreements signed in May 1972 had no real impact on the U.S. FBM assets either.

The Interim Agreement on Strategic Offensive Arms froze for five years the ICBMs and SLBMs at the level existent or under construction as of 26 May 1972. At the time no new U.S. SLBM launchers were under construction or planned for the near future. Although the Protocol to the Interim Agreement allowed an eventual numerical ceiling of 710 U.S. tubes and 44 boats, the United States had no intention of attaining the higher ceilings. [Ref. 37: pp. 522-523]

3. Technology

The most significant reason that SALT I had no effect on SLBM capabilities was the absence of stipulations involving MIRV technology. A U.S. proposed ban on MIRV was rejected by the Soviet Union in the spring of 1970. [Ref. 25: p. 62] Therefore, while freezing numbers of launchers at 1972 levels, the Navy's deterrent and retaliatory capabilities increased multifold with introduction of MIRVed Poseidon missiles to the fleet.

As stated earlier, the designers of Poseidon pursued a counterforce or anti-silo capability in the mid 1960s. In 1967 according to Joel A. Wit [Ref. 59: p. 163], the Navy would have begun the development of a stellar corrected

inertial guidance system which would yield sufficient warhead accuracy to destroy hardened targets. However, funds for such a capability were repeatedly refused by Congress between 1969 and 1973.

A counterforce SLBM would have been very effective in Secretary Schlesinger's limited options doctrine with the ability to selectively strike the Kremlin's offensive capability. Although not addressed in the signed SALT accords, MIRV and counterforce capability were major issues during the negotiating process. [Ref. 25: p. 62] Rather than inflame superpower relations with unilateral American second strike counterforce capability in a supposed era of negotiation and parity, the Congressional leadership sought to calm Soviet fears by denying U.S. SLBM's that capability. The resultant approved warhead yield - accuracy mix for Poseidon (50 KT. - 1500-1800 feet) was not capable of knocking out a hardened ICBM silo. [Ref. 48: p. 22]

In order to garner Pentagon support for the SALT accords, Nixon pledged increased support for the ULMS or Trident SSBN program. A counterforce Poseidon missile would be sacrificed for future systems capabilities. Schlesinger's predecessor, Melvin Laird, had stated his FBM objectives, which continued through the Nixon years:

> I have carefully reviewed all alternatives for new strategic initiatives and have decided that acceleration of the ULMS program is the most appropriate alternative, since the at sea portion of our sea-based strategic

forces has the best long term prospect for high pre-launch survivability. [Ref. 4, 1972-73: p. 409]

That same year, Laird proposed the development of a sea-launched cruise missile (SLCM) as a hedge against future negotiated limitations to the FBM force. [Ref. 4: p. 110]

4. Targeting and Assignment

As a reflection of the Schlesinger Doctrine, guidance for development of the SIOP in 1974 re-emphasized the targeting of a wide range of military forces and installations. Also identified were exempt or withheld sites which either would not be targeted (e.g, purely urban centers with no military-economic potential) or which would be spared in an initial exchange, such as political leadership locales needed for intra-war negotiations. [Ref. 60] SLBMs, it is presumed, were assigned targets such as unhardened military installations, airfields and troop formations, and those which would be spared initially, thus requiring a survivable reserve capability.

As an element of Schlesinger's limited options plan, some U.S. SLBM launchers were assigned to the Supreme Allied Commander, Europe in support of NATO theater operations. Potential war time assignment included selective strikes on bases and supply lines which support an enemy offensive. [Ref. 59: p. 170] This new role of tactical support for a continental conflict involving the European allies bolstered the existing treaty guarantee of protection under the American deterrent umbrella. [Ref. 56: p. 36]

H. FORD

1. Doctrine and Policy

In the summer of 1974, Gerald R. Ford assumed the Presidency, shortly thereafter naming Donald Rumsfeld as his Secretary of Defense. Rumsfeld outlined the administration's major objectives of the strategic nuclear forces to Congress, largely a reiteration of the tenets of the Nixon and Schlesinger doctrines:

1. To maintain a well-protected second strike force to deter attacks on cities and people;

2. To provide the capability for more controlled and measured responses in order to deter less than all-out attacks;

3. To ensure an essential equivalence with the Soviet Union, now and in the future;

4. To maintain stability in nuclear competition, foresaking a disarming first strike capability and seeking equitable arms agreements, where possible. [Ref. 61: p. iii]

In November 1974, President Ford and Chairman Brezhnev signed the Vladivostock Accord, agreeing to limit the total number of U.S. and Soviet strategic nuclear vehicles to 2,400, of which 1,300 could be MIRVed. [Ref. 37: pp. 523-524] The central goal of the Ford-Rumsfeld doctrine was to maintain a high confidence second strike capability within the agreed upon Vladivostock limit. Deterrence, it was hoped, would be accomplished "through flexibility and the control of nuclear escalation." [Ref. 36: pp. 20-21]

2. Force Level

The Poseidon conversion on thirty-one U.S. SSBN's was completed in 1974. Thus, the total number of warheads in the FBM force levelled off at about 4000. Although noting the advancing age of the submarines, the administration felt that the current strategic force levels were adequate for present defense plans. [Ref. 61: p. iii; Ref. 36: p. 21]

3. Technology

Donald Rumsfeld stated that an assured second strike capability is the prime condition for deterrence, the ability to destroy 30% of the Soviet population in 200 urban centers. This would "...retard significantly the ability of the U.S.S.R. to recover from a nuclear exchange and regain the status of a 20th century military and industrial power more rapidly than the United States." [Ref. 36: pp. 67-68]

However, the restraint displayed by the United States in holding to this assured destruction goal was not reciprocated by the Soviets. Rumsfeld commented on their growing offensive capability:

> The Soviets are gaining the capability in an initial counterforce attack to withhold a large percentage of their forces with which they could retaliate in kind.

On the part of the United States:

> Our own SLBMs - both on station and in transit - would still be intact, and we believe that our alert bombers would retain a high probability of penetrating to Soviet targets. But our own ability to disrupt the Soviet follow-on force and cover many other important targets of value would have diminished. Under these conditions, our flexibility would be small; theirs would remain substantial. [Ref. 61: pp. 47-49]

A growing Soviet counterforce first and third strike capability was increasing U.S. vulnerability to intra-war nuclear blackmail. A purely countervalue second strike force would mean that, following an initial exchange, the United States would have only two alternatives: to launch the assured destruction strike and cause annihilation of its own cities as well, or to abdicate to Soviet desires. Fears of such a lack of flexibility re-emphasized the need for Trident and its counterforce capability along with further improvements to the accuracy of the Poseidon missile.

4. Targeting and Assignment

As the least vulnerable leg of the strategic TRIAD, the SLBM force remained the backbone of the U.S. second strike capability. [Ref. 61: p. 65] The range of targeting options for the SSBNs remained unchanged from the Schlesinger Doctrine, including the dedication of some launchers to NATO theater operations. [Ref. 36: p. 148]

I. CARTER

1. Doctrine and Policy

In his 1979 address to the Congress on the FY 1980 Defense Budget, Secretary of Defense Harold Brown outlined President Carter's new approach in strategic doctrine. The requirement for nuclear retaliatory forces was met if those forces could "survive in adequate numbers and types after a... surprise attack; penetrate Soviet defenses...; if necessary, inflict high levels of damage on Soviet

society -- particularly those elements the Soviet leadership values..." [Ref. 62: p. 12]

As a guideline for employment of the American nuclear weapons, Brown introduced the concept of a "Countervailing Strategy." He described the new concept's meaning:

> As a reasonable minimum (but this may also be the best we can do), we can make sure that, whatever the nature of the attacks we foresee, we have the capability to respond in such a way that the enemy could have no expectation of achieving any rational objective, no illusion of making any gain without offsetting losses.

There were four strategic capability goals stipulated in the countervailing strategy:

1. Survivable C^3;
2. High weapons accuracy (and some passive defense measures;
3. A substantial target list;
4. Counterforce targeting with the ability to retarget in intra-war phases (if empty silos are targeted). [Ref. 62: p. 77]

The operational guidance for Carter's new strategy was outlined in Presidential Directive 59 (PD 59) dated July 25, 1980. It was described by the administration as a "refinement" and "codification" of previous statements of American strategic policy and not a radical new approach. [Ref. 63: p. 268] It codified the evolution away from a primarily countervalue, assured destruction strategy toward one providing greater flexibility for the National Command Authority, combining counterforce and countervalue targeting to deter Soviet aggression through the capability to respond appropriately to any level of violence. [Ref. 29: pp. 1-2]

2. Force Level

The objective of the SALT II negotiations was maintenance of essential equivalence with the Soviet Union by persuading the Kremlin to exercise restraint in their build-up of offensive forces. Again, this second round of talks had no real effect on U.S. SLBM force levels. Rather, U.S. strength would be determined by production and replacement rate of Ohio class SSBNs for older boats. Stipulated limits on total number of vehicles (2400 to 2250 by 1981), total number of MIRVed missiles (1200), and allowable warheads on MIRVed missiles (14), all provided ceilings well in excess of U.S. construction plans. [Ref. 37: p. 529] President Carter and Chairman Brezhnev both agreed to abide by the limits of the unratified accords. During the Carter administration, the FBM force was maintained at forty-one boats and 656 launchers. The commissioning of the U.S.S. Ohio, delayed until November 1981, and the retirement of the Washington class SSBNs which began that year, both occurred after his electoral defeat.

3. Technology

A second major objective of Carter's strategy was high weapons accuracy. The improved C.E.P. Trident I missile was introduced to the operational forces during his tenure and the Improved Accuracy Program for Poseidon continued.

Carter placed considerable emphasis on the modernization of the FBM force. [Ref. 64: p. 6] He wanted to

ensure survivable modern SSBNs in the future, hedging against possible Soviet ASW advances. The stated research and development goals were improved SLBM accuracy and C^3 systems to give greater effectiveness and flexibility "...in the execution of various response options and as part of a secure reserve." Support of the projected ability of the Trident II missile to target the "entire Soviet target spectrum" (ie including hardened targets) with better accuracy and throw weight was indicative of the administration's support of a counterforce SLBM capability. [Ref. 64: pp. 105-110]

Carter was careful, however, to emphasize a purely second strike intent for new strategic forces. "Survivability is the hallmark of our strategic modernization programs, for survivable retaliatory forces are the essence of deterrence." [Ref. 65: p. iv] Thus, other strategic forces deemed less survivable than SSBN's, such as the B-1 manned bomber program, failed to garner the administration's support.

4. Targeting and Assignment

In 1981, Secretary Brown emphasized that counterforce targeting for SLBMs was a capability of the future and not within the I.O.C. of the Trident I missile: "Current SLBMs lack the accuracy necessary for use against hardened targets, and will not use the full throw-weight potential of the Trident submarine launch tubes." [Ref. 65: p. 50] The role of SSBN assets in being remained a reserve force with essentially soft target assignments. [Ref. 65: pp. 40-42]

As a result of PD 59, the SIOP increased the number of potential target installations from 25,000 in 1974 to about 40,000. Included were elements of Soviet nuclear forces, conventional military forces, military and political leadership, economic and industrial targets, and other industry which would contribute to economic recovery.

The SIOP identified four general categories of options available: major attack, selected attack, limited nuclear and regional nuclear options. Within each category were subdivisions including "withholds," such as population centers and C^3 sites, the logical assignment for a reserve SSBN force in an intra-war deterrence or flexible option strategy. [Ref. 48: p. 6] The SLBMs surviving a Soviet first strike, estimated to be at least 90% of those on patrol, were capable of destroying about 75% of Soviet industrial centers alone, if no military installations were targeted. All reserve forces combined could take out the industrial base, 90% of the military facilities besides silos and between 20 and 95 million people. [Ref. 66: p. xi]

In the NATO theater, forty Poseidon launch tubes were assigned to SACEUR for European targeting as of 1980. [Ref. 67: p. 39] However, their use remains the prerogative of the National Command Authority. Carter's strategic objective of the ability to retarget missiles during a conflict, a capability currently attributed to U.S. SLBM's, could enhance a president's prerogative to assign or withhold

particular SLBM tubes to NATO according to his own assessment of operational need. [Ref. 62: p. 77; Ref. 29: p. 8]

J. REAGAN

1. Doctrine and Policy

Upon assuming office in January 1981, President Reagan announced a substantial increase in defense budgeting to redress the imbalance of military strength with the Soviet Union. His Defense Secretary, Casper Weinberger, emphasized that the United States would not seek superiority but wanted to ensure a "margin of safety necessary for our security." The build-up is planned to span all military capabilities, conventional and strategic. Further, all three legs of the nuclear TRIAD are to be expanded, including the supporting communications network. [Ref. 68: pp. I-17, I-18]

The purpose of nuclear forces in Reagan's strategic plan encompasses four objectives:

1. To deter nuclear attack on the United States and its allies;
2. To help deter conventional attack against U.S. forces and allies, especially those of NATO;
3. To impose termination of a major war on terms favorable to the United States and its allies - even if nuclear weapons have been used - and, in particular, to deter escalation in the level of hostilities; and
4. To negate possible Soviet nuclear blackmail against the United States or its allies.

The heart of Reagan's defense goals, according to the FY 1983 Defense Report, is to redress a military imbalance caused by unilateral restraint in arms build-up by the United

States. The Report claims a major contribution to the imbalance is the history of arms negotiations with the Soviets and, of greatest concern is the apparent vulnerability of the United States in the mid-1980's to a devastating Soviet counterforce first strike. [Ref. 68: p. I-39]

2. Force Level

Reagan's strategic force goals include a survivable second strike capability which deters at all levels of conflict with a "margin of safety." Although SLBM force levels have declined during his administration because of block obsolescence of the oldest SSBNs, the total number of boats is stablized at 31 for several years. Additionally, Reagan continues strong support for additional Ohio class SSBNs as "the most survivable of our nuclear offensive systems." [Ref. 68: p. I-39]

3. Technology

President Reagan has requested funding for acquisition of one Ohio class SSBN per year to a total of ten currently authorized. He has expressed continuing support for more accurate SLBM's in the future for a wide range of targets. The Improved Accuracy Program for Poseidon has been cancelled in favor of more intensive development of the more capable Trident II D-5 missile [Ref. 68: p. I-41]

4. Targeting and Assignment

In 1981 Reagan adopted PD 59 as his administration's strategic operational plan. However, the document is

currently in the process of modification to achieve a better nuclear war-fighting stance. Targeting changes include planned destruction of enemy political and C^3 centers to gain victory in a "protracted" nuclear war. [Ref. 69] Although the new Trident I missile is still not a meaningful counterforce weapon (capable of destroying hardened missile silos), it nevertheless could contribute significantly to accurate targeting of command centers which might be less hardened to overpressure than ICBM silos. Multiple warheads and great range give new SLBMs the ability to saturate targets at times of the National Command Authority's choosing. [Ref. 29: p. 6]

K. CONCLUSION

The most lauded feature of SLBMs remains their survivability in a second strike deterrence strategy. Increased capabilities through the years have multiplied the options available to national leadership as to the nature of that second strike. Never publicly seeking a first strike counterforce capability for any strategic systems, the U.S. administrations have continually relied upon the least vulnerable leg of the nuclear TRIAD as the assured destruction and/or intra-war reserve deterrence force.

VI. THE SSB AND SSBN IN SOVIET STRATEGIC DOCTRINE

A. INTRODUCTION

It is not possible to trace the development of Soviet strategic thought through a succession of administrations as in the case of the United States. Leonid Brezhnev, either alone, or together with Alexei Kosygen in the early years, was the acknowledged first among equals of the Soviet Politburo members from October 1964 to November 1982. He assumed power three years before the appearance of the Yankee class submarine. Therefore, doctrine which governs the employment of Soviet SSBNs is based on the policies of a single government or regime, although those policies reflect lessons learned and premises set forth by previous political leaders.

Theories and objectives which Brezhnev inherited from his predecessors are first traced to establish a baseline of Soviet concerns for national security and means to ameliorate threats. Doctrinal evolution is then brought forward to present day, including specifics on ballistic missile submarines. As with U.S. strategic doctrine, Soviet policies of FBM force levels, technology and targeting and operational assignment are addressed.

B. SOVIET STRATEGIC DOCTRINE

1. Definition

Identification of Soviet strategic or nuclear doctrine as opposed to conventional defense doctrine is difficult

because the Soviets do not emphasize a distinction between the two capabilities. Although nuclear weapons are recognized to have greatly increased destructive potential over conventional arms, they are viewed as an advance in weaponry on a continuum with other weapons and not as a separate categorized set of military options. Rather, the operative term which the Soviets apply to the collective plans and procedures governing the employment of all arms, including SSBNs, is "military doctrine." [Ref. 70: p. 2]

2. Development of Modern Nuclear Doctrine

After Joseph Stalin's death in 1953, the Soviet political and military leadership began to assess the viability of the deceased dictator's views of military power. His emphasis on mass and quantity of conventional arms was being rapidly overtaken by newer technologies, including thermonuclear weapons and revolutionary delivery vehicles. In 1959, Khrushchev and his advisors reached a major decision regarding strategy and war which he outlined in a speech to the Supreme Soviet in January 1960. He noted that nuclear weapons and long range delivery vehicles had revolutionized the art of warfare and announced that "our Armed Forces have to a considerable degree been switched to the nuclear rocket weapon." In summarizing he outlined the basic elements which would have a major impact on future military thought and doctrine. He stated that, because of the huge destructive power of nuclear weapons, war with the United States was no

longer inevitable. If war were to come, it would not be initiated with the crossing of frontiers, but with "rocket strikes deep in the interior." Therefore, the Soviet Union, he said, must prepare for war by possessing the means to survive a surprise attack by the United States, retaliate with massive force and survive with superior residual power. Khrushchev boasted that Soviet rockets were superior to those of the Americans and that they must retain that edge until a bilateral disarmament could be negotiated with the enemy. Finally, he announced that the potential and flexibility of nuclear weaponry precluded the need for large conventional forces. [Ref. 71: pp. 41-42]

The backbone of Khrushchev's strategy was the newly formed Strategic Rocket Forces. His stated emphasis on superiority and nuclear weapons reflected the reality of American strategic superiority and the ardent desire to narrow the gap. As Soviet inferiority diminished, doctrine evolved to encompass more diverse and potent nuclear capabilities.

James McConnell states that since 1960, Soviet efforts in development of "new independent options" in military capabilities, and doctrinal innovations which coincide with new capabilities, have appeared every five years, and are consistent with Party announced five year plans. Each set of options has refined nuclear planning and capabilities.

The Soviets initiated long range nuclear planning at the top of the escalation ladder with total force nuclear response. Since then, doctrinal and capabilities development has been refined to allow more limited options. McConnell's hypothesis traces such development through stages of a single nuclear option (1960-65), conventional war fighting capability (1966-70), limited intercontinental strategic options (1971-75), and theater nuclear forces (1976-80). [Ref. 70: pp. 3-6]

Although Soviet doctrine evolved to reflect increasing capabilities and flexibility, a number of strategic objectives and priorities remained unchanged. These constants are basic to an understanding of Soviet strategic doctrine, especially in the post-Khrushchev years.

3. Basic Elements of Doctrine

The core of Soviet war-fighting doctrine is to limit damage to the homeland. This fundamental goal leads to a counterforce targeting plan (rather than one of assured destruction) to eliminate the enemy's ability to strike, and a damage limiting policy for active and passive defenses.

Soviet plans provide for two sets of objectives. First, there must be the capability to destroy the enemy's forces in being, his system's war-making potential and his structure of government and social control. Second, there must be the ability to protect the physical structure of the Soviet government and to secure its capacity for effective operation throughout the state, to ensure survival

of a certain portion of the working population and industrial base, and to secure an alternate economic base which can contribute to rebuilding society. [Ref. 42: p. 142]

These strategic objectives translate into four types of military conflict preparedness: offensive strike into enemy territory; offensive and defensive action in theater or frontal war; homeland defense by the PVO strany or National Air Defense, and offensive and defensive action in sea and ocean theaters. [Ref. 20: p. 2] To achieve victory, strategic action emphasizes four important tactical elements: surprise, speed, joint action by all forces, and attack with a maximum combination of the previous three. [Ref. 33: p. 136]

The peace-time functions of military forces also reflect Soviet priorities of defense and homeland protection. The term "deterrence" is operative, but its achievement is conceptualized in a manner sharply contrasting with the American understanding of the term. Deterrence is achieved through the ability to fight and win a war should it fail. "Assured Destruction" is deemed irrational and is soundly rejected as undermining preparations to conduct a war-winning strategy. [Ref. 72: pp. 457-458]

The contribution of the Soviet FBM forces to doctrinal objectives will be discussed following a review of submarine and missile force levels and technology.

C. SSB AND SSBN FORCE LEVELS

Conditions in the Soviet Union in the mid-1950s were conducive to the initiation of a new strategic program such as submarine launched ballistic missiles. Nikita Khrushchev was consolidating his power. His new direction for Soviet armed forces, with emphasis on nuclear and rocket technology at the expense of conventional arms, was supported by the Twentieth Party Congress in 1956. Admiral Gorshkov's own ambitions for the VMF, as an ocean-going navy assigned offensive strategic missions with submarines and aircraft at the core, reflected the plans of the Communist Party's Central Committee for Soviet naval development. The VMF would share in the effort to redress American strategic superiority. [Ref. 35: pp. 38-40; Ref. 73: p. C-12 By 1960, however, when the Strategic Rocket Force received overwhelming support for the strategic mission, the VMF had put to sea only four ballistic missile submarines.

Nevertheless, program and construction inertia sustained the FBM build-up through the next several years, including development of the Yankee SSBN.

When a major arms build-up commenced around 1964, an already vigorous construction program was further accelerated. By 1970, the VMF had ten Yankees operational and were building six to eight a year, a rate which would surpass U.S. force levels by mid-decade. [Ref. 74: p. 10]

In just six years, thirty-four Yankees in all were completed. [Ref. 35: p. 43] Benjamin Lambeth of the Rand Corporation notes the "remarkable quiescence" and even "amity" in Party and military relations since 1967. [Ref. 75] Leaders of both factions were in agreement as to the necessity and benefit of the massive strategic programs.

When SALT negotiations began in Helsinki in the fall of 1969, the United States had about a three to one numerical advantage in SLBM launchers. [Ref. 39: pp. 199-200] The Interim Agreement, signed in May 1972, froze ICBM and SLBM levels at those existent and under construction. However, SLBM launchers could replace older land or sea-based systems. The Protocol to the Interim Agreement set the numerical ceilings of 62 submarines and 950 SLBMs for the Soviet Union, an institutionally approved superiority over American force levels, held to 44 boats and 710 SLBMs. The generous ceiling agreed upon for the Soviet FBM fleet did not affect actual construction and force levels until 1978. Although Delta submarines were joining the fleet at a rapid pace, force levels remained under the ceiling because of agreed upon exclusion of some older systems from the totals.

The Soviets took full advantage of the strategic agreements, striving 'legally' for superiority. In essence, SALT I had no effect on SLBM force levels or other systems. The U.S.S.R. numerically surpassed the United States in ICBMs in 1970, in total ballistic missiles (ICBMs and SLBMs) in

1971, and in total SLBMs in 1976. [Ref. 72: p. 458] The doctrinal goal of superiority, stipulated by Khrushchev in 1959, was institutionally sanctioned by arms limitations talks.

Two thirds of Soviet nuclear submarine construction in the 1970s was in SSBNs. [Ref. 35: p. 93] Replacement of Yankees with Deltas has levelled total counted forces at approximate SALT I limits. The unratified SALT II limits of 1320 delivery vehicles and 1200 MIRVed missiles will not affect current limits in the foreseeable future. The Soviets can concentrate on technological advances in their FBM force while enjoying a bilaterally agreed numerical superiority over the United States.

D. TECHNOLOGY

The rapid Soviet preparation for all-out nuclear war of the early 1960s included deployment of the large warhead SARK and SERB missiles. Their limited capabilities and great destructive power reflect a characteristically Soviet emphasis on mass and force vice precision and sophistication.

The technological shortcomings and difficulties of Hotel, and operational limitations associated with diesel submarines inherent in Golf, inhibited the threat of those systems to the North American continent. Rather, their capabilities were more facilitative in a regional or theater role.

It was not until 1967, with the introduction of the Yankee-Sawfly combination to the fleet, that Soviet FBM technology achieved a true intercontinental reach. Warheads continued to be large, but they now threatened U.S. military targets.

The SS-N-8 aboard Delta contributed to more limited strategic options adopted in the early 1970s such as withholding or reserve forces for intra-war deterrence. Long range missiles and quieter more capable submarines enabled more confidence of survivability in a nuclear exchange.

As emphasis shifted to theater warfare in the late 1970s, the Soviets derived continued missions for older systems. Golfs and Hotels may be assigned specific scenario and theater dependent roles such as support of amphibious operations in the Baltic or deterrence against meager nuclear forces of the Peoples Republic of China.

At the intercontinental strategic level, the recently deployed SS-N-18 allows multiple strike and targeting options via MIRV warhead technology. [Ref. 76: p. 89] The introduction of multiple independently targeted warheads to the fleet increases the potential of an FBM strike geometrically.

The Soviet Union has displayed a determination to attain the highest technology possible to increase strategic capabilities. However, they have just as consistently relied upon mass, numbers and power, as a hedge against technological failures. Their flexibility in nuclear options has been

attained through numbers of launchers and high yield vice numbers and accuracy of warheads.

Development of the MIRV capability was not hindered by arms negotiations. SALT I did not address the technology when Soviet inferiority was most distinct. SALT II, also, does not curtail significantly a concerted effort to deploy multiple warheads. MIRVed warheads, the one area in which the United States enjoys a strategic advantage, has been a relative newcomer to Soviet capabilities. Either competing priorities or slow technological advance have hindered significant exploitation of this important capability in SLBMs.

Through numerical and technological development respectively, the Soviet Union has consistently improved its strategic posture. The Soviets have steadily improved capabilities in flexible response as well as general war fighting plans. The innovative characteristics of the Typhoon SSBN prove continued dedication to increased military power through technological advances.

General doctrine, force levels and technology are manifested in Soviet utilization of their FBM force in war fighting plans. Thus, potential targets for SLBMs and operational fleet assignments reflect military and political priorities of the Kremlin leadership.

E. TARGETING AND OPERATIONAL ASSIGNMENT

1. Introduction

It is difficult to separate strategy which governs the employment of naval units, including SSBs and SSBNs, from from overall strategy as dictated by politics and preparation for fighting war. [Ref. 33: p. 19] Seaborne units are considered contributing factors in a combined arms effort, an integration of all forces, in "defense in depth" of the Soviet Union. [Ref. 35: pp. 88-89]

Soviet strategy is characteristically land-oriented with layers or rings of defense emanating from a core centered at Moscow. Defensive preparation is more intense toward the center and protection of the homeland is the primary duty of all military forces.

2. Strategic Strike

Naval units, forced by geographic realities, have always been positioned in or near the outer rings of the defensive zones and, therefore, have assumed subsidiary roles to the land forces in strategic planning. [Ref. 73: pp. C-10-16] However, as the Soviets have gained military and political power since World War II, and have attained a global reach in interests, the VMF has increased in importance to the Kremlin leadership.

Admiral Gorshkov has repeatedly stated that SSBNs are the primary striking arm of the VMF and the main reason

for his service's importance. [Ref. 73: p. C-15] The SSBNs have thus been assigned three objectives: They have responded in kind to the American Polaris/Poseidon force, equalizing a potentially unfavorable shift in the correlation of forces. [Ref. 23: p. 27] Second, they contribute to the defense of the Soviet Union as "...an indispensible part of the strategic nuclear shield of the motherland." [Ref. 35: p. 73] This objective involves both strategic deterrence and theater level war fighting. Third, SSBNs are of eminent importance to the Soviet Union because of their ability to conduct strategic strikes on the North American continent.

Gorshkov has tied the prestige of the VMF to its ability to threaten land targets, the so-called "Fleet Against the Shore" mission. In Sea Power of the State, he asserts:

> Since the goals of war have been achieved primarily by occupying enemy territory, successful naval operations against the shore have brought greater results than fleet-against-fleet operations. [Ref. 16: pp. 213-222]

Further, he feels that nuclear weapons have rendered operations against enemy fleets secondary in any defense strategy. Thus, Gorshkov articulates a strong advocacy of a strategic strike mission for his SSBN force. The SLBMs give the VMF a powerful offensive capability and put the Navy into the forefront of superpower competition. [Ref. 73: p. C-35]

Gorshkov's strategic strike role for Soviet SSBNs is not undisputed among military leaders. Detractors have noted that strategic strike is the primary mission of the SRF but not of the VMF. SLBM's, it is conjectured, would only be needed as a back-up to ICBMs for targets particularly difficult to strike. [Ref. 77: p. 76] According to Robert Herrick [Ref. 78: p. v], Soviet SSBN's do not have a share in deep strike against the continental United States, at least in a first strike scenario. Their assigned targets on the enemy mainland have been limited to coastal naval-oriented installations.

Although forward Yankee patrols gave the VMF an intercontinental reach, their missiles' targeting was limited to time-urgent counterforce shoreline elements such as C^3 structures, early warning systems and SSBN bases. [Ref. 9, 1974-75: p. 536; Ref. 35: p. 73] The Deltas, which introduced true intercontinental strike capability to the SLBM force and motivated Gorshkov's argument for fleet against shore vice fleet against fleet, still have not secured a deep strike role for Soviet SSBNs. [Ref. 35: p. 395; Ref. 78: p. ix]

Table VII summarizes Soviet SSBN assignment to the strategic strike mission according to Robert Herrick. As indicated, continental targeting is limited to coastal military sites, thus denying Gorshkov his ambitions for SSBN war-fighting responsibilities.

TABLE VII

STRATEGIC STRIKE MISSION ASSIGNMENTS OF SOVIET SSBNs, 1955-1979

Mission Assignment Concerned	1955-1961 (Prior to XXIInd Party Congress)	1961-1966 (Up to the XXIIIrd Party Congress)	1966-1971 (Up to the XXIVth Party Congress)	1971-1976 (Up to the XXVth Party Congress)	1976-1979 (Since the XXVth Party Congress)
A share with the SMF in the initial deep strike?	No	No	No	No	No
Versus SSBNs and/ or CVAs in port?	Yes	Yes (CVAs alone)	Yes (CVAs alone)	No (Lost by 5/73)	No
Versus naval bases per se?	No[1/]	No[1/]	Yes[2/]	Yes[2/]	Yes[2/]
Versus coastal targets? (Countervalue?) (Counterforce?)	No	No	Yes (Counterforce targets only)	Yes (Counterforce targets only)	Yes (Counterforce targets only)
Versus ground targets in European TVD?	No	No	No	No	No

Key: 1 - Only in the event an anti-SLOC campaign were undertaken.
2 - Only as part of the assigned coastal strike mission, so likely not targets of Navy choice.

[Ref. 78: p. ix]

3. Strategic Reserve

Soviet military writers recognize a potential state of war in which particular residual forces surviving a prolonged conflict could favorably influence a negotiated peace. [Ref. 35: p. 10]

Military elements surviving initial exchanges in a protracted war could actually help to establish the ultimate winner. These "second echelon forces" would be withheld to act as an intra-war deterrent threat to the enemy, or to control territory that cannot be physically occupied through threat of further belligerence. The Soviets refer to aircraft carriers and SSBNs as fulfilling this role for the United States. Evidence suggests that Soviet SSBNs are intended for similar employment.

From the Soviet point of view, a ballistic missile submarine's invulnerability or survivability enables its missiles to be withheld from an initial nuclear exchange for use in subsequent stages of warfare, or as a decisive force in negotiating a peace favorable to the Soviet Union. [Ref. 42: p. 144; Ref. 35: p. 397] According to Robert Herrick [Ref. 79: p. vi] the withholding role has been operative for the VMF since 1961. This would imply that even the earliest Soviet SLBMs were subject to withholding at some time. Ballistic missile submarines patrolling in contiguous waters could contribute to implementation of

of such a role. Conversely, however, it is assumed that Yankees in forward station may be exempt from the protracted withholding role because of their position and vulnerability.

Recent military exercises provide evidence of strategies which withhold SLBM assets. [Ref. 21: p. 77] The exercises include various phases of conflict from crisis, through conventional and theater nuclear stages to intercontinental exchange. Recognition of limited escalating conflict implies requirement for stratified response to any level or contingency.

Further evidence of a survivable withholding role for Soviet SSBNs is their considerable investment in maintaining safe havens for the boats to operate. Protection is provided in adjacent waters, secure from U.S. ASW and in transit or patrol areas with large mobile ASW assets. [Ref. 35: p. 84] Maintaining these bastions for SSBNs has been an official VMF mission since as early as 1960. [Ref. 80: p. iv]

The "pro-SSBN" forces must perform two missions. Until the missiles are fired, the boats must be kept secure from attack. If the submarines are deployed, they must be supported with surface and ASW protection. [Ref. 15: p. 149] Among the multiple units assigned to secure areas of SSBN operations are ASW cruisers such as MOSKVA, KRESTA II and KARA; attack submarines and ASW aircraft such as the BEAR F and IL-38 MAY. According to Michael MccGwire the most

recent Soviet ship construction is designed to thwart U.S. task forces from entering the SSBN patrol areas. BAL-COM II cruisers, KIROV command ships and the KIEV CV are designed to survive attack and remain on station continuously in the SSBN protection mission. [Ref. 81]

4. Regional Warfare and Homeland Maritime Defense

The VMF positions its defensive power including SSBs and SSBNs to increase the security of the four primary maritime approaches to the Soviet Union: to the north in the Norwegian Sea; to the east in the Baltic; to the south in the Black Sea; and in the Pacific through Tsushima and La Perouse Straits to the Sea of Japan. [Ref. 73: p. C-21]

Diesel powered SSBs have been assigned primary targets on the Eurasian land mass because the Soviets recognize a potential need to deal with the PRC in the event of war with NATO or the United States. [Ref. 82: p. 10] Units in the Baltic Sea are assigned tactical targets in support of theater operations. It is also likely that Yankees could be assigned such a role when superseded by Deltas in intercontinental targeting. [Ref. 35: p. 94]

There is some technical evidence to suggest an additional role for some Soviet SSBNs. Certain characteristics of the Yankee weapons system indicate possible targeting of maritime threats, specifically CV battle groups. [Ref. 78: p. vi] The patrol patterns of Yankee class SSBNs often bring them within range of U.S. task force transit

lanes, particularly near American home ports. [Ref. 83: p. 154] The unsuccessful SS-NX-13 missile designed for launch from Yankees had a short-range (about 500 nautical miles) and a radar guided terminal-homer warhead, suggesting a tactical marine target. The speed of Yankees is also attributed to anti-carrier warfare and the requirement to keep pace with a battle group. [Ref. 84: p. 64; Ref. 35: p. 81]

5. Counterforce Ambitions

The Soviets recognize advantages afforded by SLBMs in counterforce targeting. Shorter flight time enabled by forward patrols increases the probability of destroying time-urgent targets such as missile command posts and anti-missile-defenses. [Ref. 77: p. 77] Typhoon's under-ice patrol capabilities could contribute to a counterforce role. [Ref. 20: p. 1] Although some SLBMs may be assigned first strike roles against military-industrial targets, to date they lack the requisite accuracy to knock out hardened sites such as silos and command posts.

F. CONCLUSION

Soviet SLBM targeting and operational assignment reflect VMF priorities of homeland defense and maritime warfare. Flexibility is attained through characteristically Soviet reliance on mass and redundancy. That flexibility, however, is tempered by centralized control and integration of naval forces into combined arms plans. The mission strongly

advocated by Admiral Gorshkov for his SSBNs, that of deep strategic strike, has, thus far, eluded him, the victim of inter-service rivalry. Rather, SLBMs are most often considered a naval asset to solve naval military problems. Their most attractive characteristic, survivability, provides the SSBNs with their only role which transcends maritime concerns, that of a potential intra-war deterrent.

VII. FUTURE POTENTIALS OF SLBMS

A. INTRODUCTION

Both technological and political-diplomatic developments will shape the nature of future U.S. and Soviet submarine-based ballistic missile forces. Technology in both nations is approaching a true counterforce targeting capability for SLBMs. Arms limitations and reduction negotiations may impair or prevent their attainment of such a capability.

B. COUNTERFORCE

The technologies required for a true counterforce missile which can destroy a hardened site such as an ICBM silo are beyond the scope of this paper. The functional realities of this requirement are: 1) direct hit accuracies within the blast radius of the warhead; 2) adequate destructive force to blanket the CEP of the warhead and overcome silo protection and hardening against overpressures created by the blast; and, 3) the ability to penetrate ballistic missile defenses.

1. U.S. Counterforce and Doctrine

The American counterforce SLBM under consideration is the Trident II D-5 missile, scheduled for full scale engineering development to begin in FY 1984 and attainment of initial operating capability (IOC) by December 1989. [Ref. 68: p. III-59] The D-5 will be 42 feet long and weigh

63 tons, nearly twice the weight of any of its predecessors. The launchers of the Ohio class SSBNs are designed to accommodate the D-5.

Specific performance of the missile is highly classified. The Trident II is expected to have a range of about 6000 nautical miles. The final stage will be MIRVed with possibly seven 335 kiloton or fourteen 100 kiloton warheads, with a C.E.P. of around 400 feet. [Ref. 59: p. 167] It is assumed that the missile will also incorporate electronic and mechanical decoys and jamming devices to suppress defenses. [Ref. 4, 1972-73: p. 409]

The implications of D-5 are complex because of its impressive capabilities. Admiral P.F. Carter, Director, Strategic and Theater Nuclear Warfare Division of the Office of Chief of Naval Operations, has emphasized the missile's flexibility. D-5's soft target capability is increased over previous SLBMs because of a greater payload. [Ref. 29: pp. 4-5] Its survivability, based on the quietness and endurance of the Ohio SSBN, enhances its value as an extended or withheld deterrent in global or theater strategies. [Ref. 85: p. 74]

The D-5's accuracy and warhead yield also give it the ability to threaten ICBM silos and other hardened targets. Detractors of the weapon state that the silo destruction potential implies an intended first strike use, to strike ICBMs before launch. A first strike force impels the Soviets to

preempt with their offensive forces, thus destabilizing the nuclear balance. Herbert Scoville, President of the Arms Control Association and former Deputy Director of the C.I.A., has called Trident II "a serious arms control problem" and "basically a mistake." U.S. Congressman Thomas J. Downey, a member of the House Budget Committee study group on defense said: "Trident 2 will be the most destablizing first-strike weapon ever built." [Ref. 10]

Supporters of D-5 cite the weapon's advantages in a counterforce second strike. The system's invulnerability eliminates any potential impulse to launch pre-emptively to avoid destruction, the so-called "use or lose" problem. The missile's flexibility allows controlled and selective responses to any Soviet generated contingency. [Ref. 85: p. 74] Joel S. Wit has described D-5 as an "attractive strategic option." Responding to critics who cite the missile's destablizing effects, he retorts that all U.S. advances in strategic arms, including MX, cruise missiles and Pershing 2, drive the Soviets to pre-empt. [Ref. 10]

The Reagan administration has indicated continued support for D-5 development. The Improved Accuracy Program for Poseidon has been curtailed in favor of more intensive efforts in the new missile. [Ref. 68]

Ultimate force levels of Trident I and Trident II equipped SSBNs depend upon a number of factors. The great cost of the programs will be among the most important

considerations. The FY 1983 Budget applies roughly 8% of the Navy's resources to strategic systems. That figure must increase with continued construction of SSBNs. [Ref. 86: pp. 18-19]

Maintaining a warhead strength of around 4000 warheads would require fifteen to twenty Ohio class SSBNs. (10 warheads per missile, 24 missiles per submarine). Current and planned support facilities at Bangor and Kings Bay indicate a total force of twenty boats. Other speculations produce additional figures.

2. Soviet Counterforce and Doctrine

Unique physical characteristics of the Typhoon class SSBN indicate potential counterforce targeting assignment. Its ability to break through the Arctic ice pack and launch its missiles from a position close to the United States enhances the submarine's capability to strike a time-urgent target such as an ICBM silo. The one Typhoon completed is now undergoing sea trials and operational status is expected by mid-decade.

The missile under development to be launched from Typhoon is the solid fuel SS-NX-20. Larger than the SS-N-18, the new SLBM is projected to have a range of 4500 to 5000 nautical miles. Its terminal stage will be MIRVed with about twelve warheads and could complete the counterforce potential of the Typhoon system. [Ref. 20: p. 9; Ref. 11, 1981-82: p. 476]

Since counterforce strikes are an integral facet of Soviet strategic doctrine, a counterforce SLBM would enhance but not revolutionize Kremlin plans. It might, however, improve the prestige and importance of the VMF in military strategy, achieving the deep strike assignment that Gorshkov covets for his service.

Those men who succeed Leonid Brezhnev in Party and state leadership are not likely to implement any quick or major changes in Soviet doctrine. Strategic goals of nuclear stalemate with the United States by increased numbers and quality of weapons and expansion and projection of interests into the Third World are likely to remain operative and stable into the next decade. [Ref. 73: p. C-50; Ref. 87: p. 477] Since the Soviets are apparently behind the United States in SLBM counterforce capability, they will likely attempt to maintain parity in this area through negotiation.

C. ARMS NEGOTIATIONS

Current superpower arms negotiations which concern SLBM systems are the Strategic Arms Reduction Talks in Geneva, Switzerland which began in July 1982. SALT I has expired but both the United States and the Soviet Union have agreed to abide by the limitations of those talks and the unratified SALT II accords. The Soviets appear to be holding their operational systems to rough SALT I limits. No currently completed negotiations actually affect U.S. production and development. Other factors discussed in Chapter V have held

American SLBM forces at lower levels to date. It appears that slow technological development in the case of the Soviet Union and alternate systems priorities in the United States have kept MIRVed warheads below the fourteen re-entry vehicle limit of SALT II. [Ref. 88]

President Reagan is reported to be seeking a fifteen to fifty per cent reduction in strategic firepower in START negotiations. He intends to bypass limits in launching systems in favor of controlling the numbers of warheads, in which the United States maintains a lead, and throw weight, in which the Soviets have superiority. [Ref. 89] Reagan does not intend to sacrifice the MX ICBM, B-1 bomber or the Trident II missile in the negotiations. [Ref. 90]

The Soviet Union has made a public counterproposal which would cut Soviet and American missile and bomber forces. Included are recommendations to curb new SSBN production by both nations and a ban on cruise missiles and D-5 without concessions or their part. [Ref. 91]

D. CONCLUSION

U.S. SLBM capabilities in the future seem more assured than in the Soviet Union. It is certain that if D-5 is negotiated away, it should cost the Soviets a considerable strategic capability in turn. A survivable counterforce FBM fleet would be a significant military asset to either nation and a major input in the future strategic balance.

VIII. CONCLUSIONS

A. INTRODUCTION

The concept of submarine-based ballistic missiles has produced two sometimes congruent and sometimes divergent tracks of weapon system and strategic doctrine development in the United States and Soviet Union. Several conclusions can be drawn from the similarities and contrasts of each nation's technology, operational policies and nuclear doctrine to assess effectiveness of the FBM forces in pursuit of national security and future roles those forces might assume in international relations.

B. WEAPONS SYSTEMS AND TECHNOLOGY

1. Submarines

From the outset of the FBM program, the United States has sought the highest quality and state of the art technology for the Navy's SSBNs. The nation's best efforts in shipbuilding, electronics and power plants have been incorporated into the single system, producing a high quality platform. All U.S. deterrent submarines are nuclear powered, enabling a quiet boat, virtually undetectable acoustically, with long endurance and total independence of operation on patrol. Their best defense is their silence and stealth.

For twenty-two years, the U.S. FBM force consisted of only four classes of boats, all with sixteen launch tubes.

The latest SSBN, the Ohio, although incorporating the latest advances in computer technology, quieting and habitability as well as increasing the launchers to twenty-four, nevertheless exhibits many of the design characteristics of the previous classes. Ohio reflects the consistent trends of larger, more capable boats that each successive class has brought.

Although putting an operational ballistic missile submarine to sea two years before the United States, the VMF's early systems were far behind their American counterparts in technology and capability. The Zulu V's, Golfs and Hotels all carried very few missiles. The power plants of all three are inadequate for a strategic mission. Diesel power on Zulu V and Golf required frequent snorkling, negating any possibility of long term stealth. Hotel's nuclear plant was so inadequate, it too never presented a credible threat to North America.

It was not until Yankee put to sea in 1967 that the VMF effectively answered the U.S. FBM challenge. Very similar in design and capability of the early American SSBNs, the Yankees were first in presenting a real maritime strategic threat to the United States.

While American SSBN production stagnated in the late 1960's, the Soviet Union began construction of a third generation fleet, the Delta series SSBNs, which have brought the VMF superiority in numbers of boats and launchers since the

mid-1970's. Larger and quieter than previous classes, the Deltas approach or surpass previous U.S. capabilities and technology.

Typhoon, in contrast to Ohio, represents a departure from previous Soviet SSBN design practices. Its immense size, the incorporation of two reactors and the missile section forward of the sail, revolutionize submarine construction. The real meaning of Typhoon's radical design is not known, but it displays a Soviet willingness to innovate and attempt new approaches to pace or surpass U.S. capabilities in SSBNs.

Although producing several classes and many modifications in their ballistic missile submarine program, the Soviets have maintained some consistencies. Like the United States, the SSBNs have increased in size and capability over predecessors. They are generally noisier than American boats with more powerful main plants. For instance, the reactor of Ohio, the second largest in the Navy's entire inventory, produces 60,000 shaft horsepower as opposed to the 120,000 total SHP of Typhoon. These powerful and noisy plants appear to reflect less dedication, on the part of the Soviets, to stealth as the foremost criterion for weapon system capability.

2. Missiles

Comparison of U.S. and Soviet missiles mirrors many of the particular SSBN characteristics of each FBM force.

The Polaris missile had a limited range and crude accuracy. However, the size of its warhead and the mobility of its launch platform made Polaris a formidable weapon from the outset. The SSBN's ability to patrol undetected in the Arctic and Mediterranean brought the one megaton warheads to bear on Soviet cities from 1960 on.

However, the early Soviet SLBM's, the SS-N-4 and SS-N-5, although lifting a powerful warhead, were precluded from posing a serious intercontinental threat by short range and inadequate platforms. Again, not until 1967, with introduction of the 1600 nautical mile SS-N-6, the Soviets first attained a comparable FBM threat to the United States.

While numbers of SSBNs stagnated in the U.S. Navy, the FBM force geometrically increased its total warheads by conversion to the MIRV Poseidon on thirty-one boats. Since its introduction to the fleet in 1971, Poseidon has enabled a total warhead complement of over 4000 independently targeted vehicles. The Soviet Union, although surpassing the United States in numbers of subs and launchers, did not respond in kind with its own MIRV until 1978 with the SS-N-18. Total Soviet SLBM warheads remain roughly a third in number of their counterparts.

The U.S. Trident I C-4 brings an increase in accuracy and some range over Poseidon. However, it must be considered an interim weapon, without the great impact and step level increase in capability that Polaris, Poseidon and D-5 represent.

Since the introduction of the SS-N-8 to the VMF in 1972, Soviet SLBMs have retained superior range and megatonnage to U.S. missiles. With operational ranges in excess of 4000 nautical miles, the SS-N-8 and SS-N-18 threaten U.S. targets from Soviet home waters. Generally, American MIRVed missiles have light (50KT) warheads and ranges which enable extensive operational patrol areas.

The U.S. Navy abandoned the volatile and complex liquid fuel missile engines early in the FBM program. All U.S. SLBMs are solid fuel, requiring less maintenance and preparation for launch.

With the exception of the SS-N-17 deployed on a single Yankee and the experimental SS-NX-20, the Soviets have relied upon liquid fuel engines for their SLBMs. Based on the American experience with liquid fuel, the VMF's ability to maintain readiness in its missiles must be problematic.

3. Summary

In summary, while U.S. technology remains superior to the Soviets in SSBN stealth and warhead numbers and accuracy, the Soviets have effectively compensated with large numbers of quite capable submarines and powerful missiles. While the United States held an unquestionable lead in FBM forces from 1960 until the mid 1970s, the Delta fleet equipped with long range missiles has narrowed U.S. strategic superiority to numbers of SLBM warheads only. The VMF, through different SSBN deployment practices summarized in

following sections, has effectively negated any disadvantage incurred from noisy power plants.

C. OPERATIONS

1. Personnel

The personnel assigned to SSBNs in the U.S. Navy and the VMF are highly trained, part of an elite force within the services. In the United States, the submariners cross-qualify in many skills and positions aboard the boats. Soviet officers and senior enlisted men endure long sea assignments, often in the same submarines for years. The VMF also assigns conscripts to their SSBNs. It is assumed that their duties are extremely limited; at best, exposing the young sailors to the rigors of submarine life and preparing them for subsequent skilled billets as warrant officers.

2. Basing and Support

The Polaris missile's range necessitated forward basing and support for the U.S. FBM force. Any similar support received by Yankees on station off the North American coastlines is a matter of conjecture.

However, for both nations, the longer ranges of second and third generation SLBMs have precluded most of the requirements for remote or forward support. The trend for the United States has been to pull back home ports and support facilities to contiguous waters and to base SSBN squadrons in a handfull of facilities. Similarly, the Soviet Union concentrates its FBM force in a few major ports.

The routine and major maintenance requirements for U.S. SSBNs, it is concluded, must be greater than for Soviet boats because of their more rigorous patrol schedules. While American boats are at sea more than half of their operational life, the tendency is for VMF submarines to spend the majority of their time pierside. Major overhaul on U.S. SSBNs occurs about every six years and approximately eight to nine years on Soviet submarines.

3. Patrols

The U.S. Navy maintains about 50% to 55% of its SSBNs on patrol at all times. The boats operate independently, communicating in a receive-only mode with elements of the National Command Authority.

Soviet SSBNs, for the most part, patrol in limited areas, strongly defended by supporting surface ships, aircraft and SSNs. Usually, only 15% or less of the total FBM force is at sea at any time.

The Yankee forward patrols are an exception to current operational doctrine. Their patrol stations, far from contiguous waters, require long transit times necessitating considerable at-sea periods of virtually independent operations.

4. Communications

The FBM communications networks of both the United States and Soviet Union are secure and redundant, based on VLF stations with myriad back-up systems. All SSBNs are

centrally controlled by the highest command echelons. Their responsiveness in wartime situations is a continuing challenge to U.S. and Soviet leadership. Communications, as a vital facet of C^3, is the most important and vulnerable aspect of strategic force effectiveness.

D. DOCTRINE

1. Deterrence

The consistently stated objective of U.S. strategic forces in peacetime is deterrence of a Soviet nuclear strike. The Soviets are theoretically deterred by the American capability to respond with a second strike which would destroy Soviet society. Two key elements define U.S. strategy. First, strategic forces must be able to survive a Soviet offensive first strike because government leaders have always denied a U.S. first strike capability. Second, deterrence is guaranteed by the threat of assured destruction, a punitive second strike.

The Soviets similarly believe that strategic forces promote the absence of war between superpowers through deterrence. However, to Kremlin theorists, deterrence is achieved through the capability to win a nuclear war should deterrence fail. By striving to attain a war-winning posture, at the very least, the enemy would clearly perceive his own inability to win a global conflict. Thus, deterrence is successful because the United States is denied its own war-winning posture and is threatened by the Soviet capability to do so.

However, so long as the 'imperialists' maintain and build offensive forces, the Soviet military must also retain the ability to survive an enemy attack and prevail with superior offensive arms.

2. War-Fighting

American war-fighting doctrine reflects the efforts by successive administrations to achieve flexibility and increased capabilities for a second strike scenario. The ultimate deterrent of assured destruction is omnipresent but, as weaponry has grown more sophisticated, precise and numerous, the nature of a retaliatory second strike has become more pliable and subject to prerogative.

Single-strike massive retaliation was succeeded by damage limitation defense and counterforce offensive. The perceived strategic instability of this doctrine and its great cost led to bilateral assured destruction which was superseded by limited strategic options and flexible response. The Carter, Ford and Reagan administrations have all expanded the role of strategic forces in a flexible response strategy while consistently espousing a second strike only offensive force.

Soviet war fighting doctrine is based on the central priority of defense of the homeland. As military capabilities have increased, the Kremlin has added additional stones to the wall around the Soviet Union.

As a reflection of deterrence theory, the primary means of achieving homeland security is through offensive capability. The threat of taking the front of a global war as far from Moscow as possible ensures its safety. However, as a hedge against enemy penetration, rings or layers of defensive forces provide a homeland defense in depth. Whether the theater of war is distant from or within Soviet territory, doctrine holds that military forces will be deployed to take advantage of elements of surprise and speed and through a combined arms approach. Though nuclear weapons provide much greater destructive potential than conventional arms, they are one element of a continuum of military war-fighting options.

3. SLBM Contribution

U.S. SSBNs have been most useful to strategic planners because of their survivability or invulnerability. Thus, their missiles are a guarantee of a second strike assured destruction capability. Essentially lacking the accuracy for counterforce targeting, they have consistently retained the assignment of soft urban-industrial areas. Improved technology has generally been limited to better SSBNs to enhance stealth and survivability and increased numbers of warheads on missiles through MIRV to create more flexible options. As response options have increased, more diverse roles for SLBMs have been conceived, including an intra-war deterrent force or strategic war-fighting reserve and the

NATO theater role. The mission thus far denied SLBMs, that of counterforce or silo destruction, could have been achieved as early as 1972 with improved Poseidon missiles. International and domestic politics and not technology have withheld that capability from the FBM force.

Soviet SLBM targeting, for the most part, has been limited to maritime objectives, either coastal support and basing sites or enemy vessels. However, the VMF dedicates substantial resources to the protection of SSBN operations "havens" with surface, subsurface and aircraft. Thus, SSBNs must be a force to be protected during a conflict, possibly as a reserve strategic strike asset. It is believed that at least some SLBMs would be withheld from an initial nuclear strike to act as an intra-war deterrence and influence superpower negotiations in a way favorable to the Soviet Union.

Forward-stationed Yankees or any other SSBNs on remote patrol could also be useful in some counter-military targeting. A shortened missile flight time enabled by their proximity to target enhances missile effectiveness against time-urgent sites such as bomber bases and C^3 centers.

Some Soviet SSBs and SSBNs are also assigned specialized theater war-fighting roles in the Baltic and Pacific in anti-NATO or anti-PRC strikes.

Admiral Gorshkov's desired mission for his SSBN's, that of a deep strategic strike against U.S. offensive force

ICBMs, has thus far been denied Soviet SLBMs because of either bureaucratic prerogatives and preferences for the SRF in such a role, or inadequate technological development in warhead accuracy.

4. Force Levels and Technology

The United States' most consistent force-level policy has been that of sufficiency in numbers, relying on superior technology to keep pace with Soviet strategic forces. Such policy caused the stagnation of U.S. FBM forces at 41 boats and 656 launchers for thirteen years.

The Soviets display a consistent trend of building large and numerous forces, including SSBNs and missiles. They emphasize technology but hedge against its failure with numbers and destructive power. It is apparent that modern Soviet SSBN construction has levelled off recently because of strategic arms agreements as much as feelings of force sufficiency for national security.

The United States remains dedicated to high technology. This results in higher cost systems and hence, generally fewer numbers. Again, the Soviets place first priority of any technological breakthroughs in application to weaponry, but tend more to rely on mass, quantity and redundancy in forces including FBM's.

5. The Future

With the projected IOC of the Trident D-5 missile, the United States appears to be on the brink of a true

counterforce SLBM capability. The future potential of the Soviet Typhoon and the SS-NX-20 is more problematic. Both submarine and missile appear to be intended for counterforce assignment. The future of FBM technology and employment will be determined by U.S. intentions and resolve and Soviet advances in capabilities. Either nation's progress in attaining counterforce SLBMs could be impaired or halted by domestic politics, international arms negotiations or failure of scientific and technological concepts.

LIST OF REFERENCES

1. Sapolsky, H.M., The Polaris System Development, Harvard University Press, 1972.

2. Polmar, N., Strategic Weapons: An Introduction, Crane, Russak & Co., 1975.

3. Gimpel, H.J., The United States Nuclear Navy, Franklin Watts, 1965.

4. Blackman, R.V.B., ed., Jane's Fighting Ships, vols. 1958-1972, Sampson Low, Marston & Co.

5. New York Times, 3 December, 1978, p. 32.

6. Scoville, H., "Missile Submarines and National Security," Scientific American (June 1972): 15-27.

7. Polmar, N., The Ships and Aircraft of the U.S. Fleet, 12th ed., Naval Institute Press, 1981.

8. "New Technology and Deterrence," Strategic Survey 1977, International Institute for Strategic Studies.

9. Moore, J.E., ed., Jane's Fighting Ships, vols. 1974-1975, Netherwood Dalton & Co.

10. "Trident's Technology May Make It a Potent Rival to Land-Based Missiles," New York Times, 13 July 1982, p. C-1.

11. Moore, J.E., ed., Jane's Fighting Ships, vols. 1976-1981, Franklin Watts.

12. U.S. Congress. Senate. Armed Services Committee. Strategic Submarine Programs, by Rear Admiral Frank B. Kelso II, Statement Before the Strategic and Theater Nuclear Forces Subcommittee, 5 March 1982.

13. Cabot, Lon, "Interchangeable Sub Crews," All Hands (June 1981): 12-17.

14. Polmar, N., "Soviet Nuclear Submarines," U.S. Naval Institute Proceedings (July 1981): 31-39.

15. Leebaert, D., ed., Soviet Military Thinking, George Allen & Unwin, 1981.

16. Gorshkov, S.G., The Sea Power of the State, Permagon, 1979.

17. Breyer, S., Guide to the Soviet Navy, United States Naval Institute, 1970.

18. U.S. Department of Defense, Report of the Secretary of Defense to the Congress on the FY 1981 Budget, FY 1982 Authorization Request and FY 1981-1985 Defense Programs, (Washington: Government Printing Office, 1980).

19. Cracknell, W.H., Understanding Soviet Naval Developments, 4th ed., Office of the CNO, 1981.

20. McConnell, J.M., "Possible Counterforce Role for the Typhoon," Professional Papers 347 (March 1982).

21. Daniel, D.C., "Navy," Soviet Armed Forces Review Annual 3 (1979), Academic International Press, pp. 66-102.

22. Seiler, M., "Submarine Patrol-Life in an Alien World," Los Angeles Times, 10 October 1977, p. II-1.

23. U.S. Department of Defense, Statement to the Congress on the Defense Posture of the United States for FY 1979, (Washington: Government Printing Office, 1978)

24. U.S. Department of Defense, United States Military Posture for FY 1980, (Washington: Government Printing Office, 1979).

25. Van Cleave, W.R., "The U.S. Strategic Triad," The U.S. War Machine, Crown Publishers, 1978.

26. Dukert, J.M., Nuclear Ships of the World, Conard, McCann & Geoghegan, 1973.

27. Progress in Arms Control?, W.H. Freeman and Co., 1979.

28. Burke, G.K., "The Need for Trident," U.S. Naval Institute Proceedings (November 1978): 33-41.

29. U.S. Congress, Senate, Armed Services Committee, Sea Based Deterrent, by Rear Admiral Powell F. Carter, Jr., Statement Before the Subcommittee on Strategic and Theater Nuclear Forces, 27 February 1981.

30. U.S. Congress, Senate, Armed Services Committee, Authorization for Military Procurement, Research & Development and Active Duty, Selected Reserve and Civilian Personnel Strengths. 94th Cong., 2nd Sess., 1976, Part 6, p. 3357.

31. Welander, R.O., The Deterrent Role of the Sea-Launched Ballistic Missile Force, American Institute of Aeronautics and Astronautics, 1974.

32. Moore, J.E., Jane's Pocket Book of Submarine Development, Collier Books, 1976.

33. Bathurst, R.B., Understanding the Soviet Navy: A Handbook, Naval War College Press, 1979.

34. U.S. Department of Defense, Statement of the Secretary of Defense Before the House Armed Services Committee on the FY 1974 Defense Budget and FY 1974-1978 Program, (Washington: Government Printing Office, 1973).

35. Nitze, P.H. and Sullivan, L., Securing the Seas, Westview Press, 1979.

36. U.S. Department of Defense, Report of the Secretary of Defense to the Congress on the FY 1978 Budget, FY 1979 Authorization Request and FY 1978-1982 Defense Programs, (Washington: Government Printing Office, 1977).

37. Jordan, A.A. and Taylor, W.J., American National Security-Policy and Process, Johns Hopkins University Press, 1981.

38. Dulles, J.F., A Speech Before the Council on Foreign Relations, January 12, 1954, reprinted and edited from Department of State Bulletin, 30, no. 791 (25 January 1954).

39. Divine, R.A., Since 1945: Politics and Diplomacy in Recent American History, John Wiley & Sons, 1979.

40. Polmar, N. and Paolucci, D.A., "Sea-Based 'Strategic' Weapons for the 1980s and Beyond," U.S. Naval Institute Proceedings (May 1978): 99-113.

41. U.S. Department of Defense, Annual Report of the Secretary of Defense for FY 1959, (Washington: Government Printing Office, 1958).

42. MccGwire, M., "Naval Power and Soviet Global Strategy, "International Security (Spring 1979).

43. Kahan, J.H., Security in the Nuclear Age, Brookings Institute, 1975.

44. Taylor, M.D., The Uncertain Trumpet, Harper & Row, 1960.

45. McNamara, R.S., An address given at Ann Arbor, Michigan, June 16, 1962, Reprinted and edited from Department of State Bulletin, 47, No. 1, 202 (9 July 1962).

46. U.S. Congress, Senate, Armed Services Committee. Military Authorization and Defense Appropriations for Fiscal Year 1966. Hearings Before the Committee on Armed Services and the Subcommittee on Department of Defense of the Committee on Appropriations, 89th Cong., 1st Sess., 9 July, 1962, pp. 64-69.

47. U.S. Department of Defense, Annual Report of the Secretary of Defense for Fiscal Year 1961, (Washington: Government Printing Office, 1960).

48. Ball, D., "Deja Vu: The Return to Counterforce in the Nixon Administration," California Arms Control Seminar, 1974.

49. U.S. Department of Defense, United States Military Posture for 1961, (Washington: Government Printing Office, 1960).

50. "How to Blow Up the World," New Statesman, 27 June 1980.

51. U.S. Congress, House, Appropriations Committee, Department of Defense Appropriations for 1963, Part 2, p. 13.

52. U.S. Department of Defense, Annual Report of the Secretary of Defense for FY 1964, (Washington: Government Printing Office, 1963).

53. Nathan, J.A. and Oliver, J.K., United States Foreign Policy and World Order, 2nd ed., Little, Brown & Co., 1981.

54. U.S. Department of Defense, Statement of the Secretary of Defense Before the Senate Armed Services Committee on the FY 1969-73 Defense Program and 1969 Defense Budget, (Washington: Government Printing Office, 1968).

55. U.S. Department of Defense, Statement of the Secretary of Defense Before the Senate Armed Services Committee on the FY 1972-76 Defense Program and the 1972 Defense Budget, (Washington

56. U.S. Department of Defense, Statement of the Secretary of Defense Before the Senate Armed Services Committee on the FY 1973-1977 Defense Program and the 1973 Defense Budget, (Washington: Government Printing Office, 1972).

57. U.S. Department of Defense, Report of the Secretary of Defense to the Congress on the FY 1975 Defense Budget and FY 1975-1979 Defense Program, (Washington: Government Printing Office, 1974).

58. U.S. Department of Defense, Statement of the Secretary of Defense Before a Joint Session of the Senate Armed Services Committee and the Senate Subcommittee on Department of Defense Appropriations on the FY 1971 Defense Program and Budget, (Washington: Government Printing Office, 1970).

59. Wit, J.S., "American SLBM: Counterforce Options and Strategic Implications," Survival (July/August 1982): 163-173.

60. U.S. Congress, House, Armed Services Committee, Hearings on Military Posture & E.R. 1872, (1979), Book 1 of Part 3, pp. 6-26.

61. U.S. Department of Defense, Report of the Secretary of Defense to the Congress on the FY 1977 Budget and its Implications for the FY 1978 Authorization Request and the FY 1977-1981 Defense Programs, (Washington: Government Printing Office, 1976).

62. U.S. Department of Defense, Report of the Secretary of Defense to the Congress on the FY 1980 Budget, Fy 1981 Authorization Request and FY 1980-1984 Defense Programs, (Washington: Government Printing Office, 1979).

63. "American Nuclear Doctrine," Survival 22 (November/December 1980): 267-271.

64. U.S. Department of Defense, Report of the Secretary of Defense to the Congress on FY 1979, (Washington: Government Printing Office, 1978).

65. U.S. Department of Defense, Report of the Secretary of Defense to the Congress on the FY 1982 Budget, FY 1983 Authorization Request and FY 1982-1986 Defense Programs, (Washington: Government Printing Office, 1981).

66. Shewmaker, J.B. and Tietz, M.R., Retaliatory Issues for the U.S. Strategic Nuclear Forces, U.S. Government Printing Office, 1978.

67. Martin, J.J., "Trends and Asymmetries in the Theater Nuclear Balance: How the Soviet Union Came to Dominate the Escalation Process," 3 November 1981.

68. U.S. Department of Defense, Report of the Secretary of Defense to the Congress on the FY 1983 Budget, FY 1984 Authorization Request and FY 1983-1987 Defense Programs, (Washington: Government Printing Office, 1982).

69. Scheer, R., "Strategy for Protracted Nuclear War Awaits Reagan Approval," San Jose Mercury News, 15 August 1982, p. 5A.

70. McConnell, J.M., Briefing: Soviet Doctrine, Past, Present and Future, Center for Naval Analysis, 1980.

71. Scott, H.F. and Scott, W.F., The Armed Forces of the USSR, Westview Press, 1981.

72. Snow, D.M., "Current Nuclear Deterrence Thinking," International Studies Quarterly (September 1979): 445-486.

73. "The Navy Strategic Planning Experiment," The Maritime Balance Study, Office of the CNO, 1979.

74. "The Shifting Balance of Military Power," Supplemental Statement to Report of U.S. Blue Ribbon Defense Panel, (Washington: Government Printing Office, 1970).

75. Lambeth, B.S., How to Think About Soviet Military Doctrine, Rand Corporation, 1978.

76. McConnel, J., The Interacting Evolution of Soviet and American Military Doctrines, Center for Naval Analysis, 1980.

77. Douglass, J.D. and Hoeber, A.M., Soviet Strategy for Nuclear War, Hoover Institute Press, 1979.

78. Herrick, R.W., Soviet SSBN Roles in Strategic Strike Part I, Final Report on Soviet Naval Mission Assignments, Ketron, 1979.

79. Herrick, R.W., A Protracted Withholding Role for Soviet SSBN's? Part III, Final Report on Soviet Naval Mission Assignments, Ketron, 1980.

80. Herrick, R.W., The SSBN-Protection Mission Part II - Final Report Soviet Naval Mission Assignments, Ketron, 1979.

81. MccGwire, M., "A New Trend in Soviet Naval Developments," International Defense Review 5 (1980): 675-680.

82. Speed, R.D., Strategic Deterrence in the 1980s, Hoover Institute Press, 1979.

83. MccGwire, M., Soviet Naval Developments, Praeger, 1973.

84. Clawson, C.H., "The Wartime Role of Soviet SSBNs - Round Two," U.S. Naval Institute Proceedings (March 1980) 1980): 64-71.

85. "Reagan and Strategic Forces: The Importance of the Devil's Alternative," Armed Forces Journal International (April 1981): 62-83.

86. U.S. Department of Defense, Report by the Chief of Naval Operations Before the Subcommittee on Defense of the House Committee on Appropriations on the FY 1983 Military Posture and FY 1983 Budget of the U.S. Navy, (Washington: Government Printing Office, 1982).

87. Miller, M.E., "Soviet Strategic Thought: The End of An Era?" International Security Review (Winter 1980-1981): 477-510.

88. Reeves, R., "Civil Talk About Blowing Up the World," San Jose Mercury News, 5 September, 1982, p. 76.

89. Martin, D.C., "A U.S. Start on START," Newsweek (29 March, 1982): 20.

90. Getler, M., "U.S. Won't Give Up the MX or Trident II in START Bargaining, High Official Says," Washington Post, 25 June 1982, p. 18.

91. Toth, R.C., "Soviets in Surprise Proposal to Cut Arms 25 Percent," Los Angeles Times, 12 September 1982.

INITIAL DISTRIBUTION LIST

		No. Copies
1.	Defense Technical Information Center Cameron Station Alexandria, Virginia 22314	2
2.	Library, Code 0142 Naval Postgraduate School Monterey, California 93940	2
3.	Department Chairman, Code 56 Department of National Security Affairs Naval Postgraduate School Monterey, California 93940	1
4.	Dr. D.C. Daniel, Code 56Dl Department of National Security Affairs Naval Postgraduate School Monterey, California 93940	1
5.	Dr. F.M. Teti, Code 56Tt Department of National Security Affairs Naval Postgraduate School Monterey, California 93940	1
6.	Dr. D.S. Yost, Code 56Yo Department of National Security Affairs Naval Postgraduate School Monterey, California 93940	1
7.	Center for Naval Analyses 2000 North Beauregard Street P.O. Box 11280 Alexandria, Virginia 22311	1
8.	LCDR Thom W. Ford, USN Commander Carrier Group Six FPO New York, New York 09501	1

Thesis
F5797 Ford
c.1 Ballistic missile submarines of the United States and the Soviet Union: a comparison of systems and doctrine.